**Ministry of Finance, China**

**GFDRR Global Facility for Disaster Reduction and Recovery**

**the World Bank**


# Supporting Sustainable

## Post-Earthquake Recovery in China

中国财政经济出版社

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# Editorial Board

# Acknowledgements

In recent years, major natural disasters have occurred frequently. The Indian Ocean Tsunami, Snowstorms in Southern China, Wenchuan Earthquake, and Hurricanes in the Southern United States and so on, all have caused a large number of casualties and huge property losses. How to respond to these sudden catastrophes promptly, rapidly and efficiently, and to resume normal production and life in the disaster areas as soon as possible and regain the capacity for sustainable development has become an arduous task placed before the governments and administrative authorities all over the world. In face of the sudden Wenchuan Earthquake, the Chinese government organized and conducted the fastest rescue in history, mobilized the widest range with the biggest input power in the earthquake relief struggle, and saved the maximum lives of the affected people, reduced the maximum losses caused by the disasters. Its response speed, the ability to mobilize various kinds of resources, post-disaster reconstruction effort, and the efficiency of various measures made the whole world see China with a new light.

In order to summarize China's experience in post-disaster recovery and reconstruction, under the help of the World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR), the Chinese government organized and implemented the project of Supporting Sustainable Post-Earthquake Recovery in China, carried out the deep and meticulous investigations, made the comparative study of the recovery and reconstruction experiences in the main affected disaster areas both at home and abroad, and summarized China's experience in post-disaster recovery and reconstruction for the reference and sharing of the international community.

The research has got high attention and strong support from the International Department and Economic Construction Department, Ministry of Finance who has provided a lot of guidance and guarantee for carrying out the research smoothly. We also appreciate a lot for the financial assistance from GFDRR, and a great number of resources offered by the World Bank. We are also grateful for the big help provided by local governments of Sichuan, Gansu and Shaanxi provinces, etc.

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# PART ONE

## Follow-Up Study on the Progress of Postdisaster Reconstruction after the Wenchuan Earthquake: Master Report on Evaluation of Reconstruction Efforts

# 1

# Earthquake Losses and Relief Work

## Geographic Position and Geological-Ecological Environment of the Affected Areas

According to the evaluation issued by the Ministry of Civil Affairs and others, the Wenchuan Earthquake disaster areas involved 51 counties, cities, for districts in Sichuan, Gansu, and Shaanxi, including 39 counties, cities, or districts in Sichuan, 8 counties, cities, or districts in Gansu, and 4 counties, cities, or districts in Shaanxi. These areas are in southwest China, including southeast Sichuan, southeast Gansu, and southwest Shaanxi (see table 1. 1).

**Table 1. 1** **Areas Affected by Wenchuan Earthquake**

| Province | Counties, cities, and districts | Number |
|---|---|---|
| Sichuan | Wenchuan County, Beichuan County, Mianzhu County, Shifang County, Qingchuan County, Mao County, An County, Dujiangyan City, Pingwu County, Pengzhou City, Li County, Jiangyou City, Lizhou District in Guangyuan City, Chaotian District in Guangyuan City, Wangcang County, Zhitong County, Youxian District in Mianyang City, Jingyang District, Deyang City, Xiaojin County, Fucheng District in Mianyang City, Luojiang County, Heishui County, Chongzhou City, Jiange County, Santai County, Langzhong City, Yanting County, Songpan County, Cangxi County, Lushan County, Zhongjiang County, Yuanba District in Guangyuan City, Dayi County, Baoxing County, Nanjiang County, Guanghan City, Hanyuan County, Shimian County, and Jiuzhaigou County | 39 |
| Gansu | Wen County, Wudu District in Longnan City, Kang County, Cheng County, Hui County, Xihe County, Liangdang County, and Zhouqu County | 8 |
| Shaanxi | Ningqiang County, Lueyang County, Mian County and Chencang District in Baoji City | 4 |

Source: Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction (State Council, September 2008).

In terms of topography, the disaster areas are in the transition zone from the Tibetan Plateau to the Sichuan Basin, and are demarcated by the Longmen Mountains. The areas' geological landforms are complex, and include plains, hills, plateaus, and high mountains; and the climates are varied. Some areas have significant differences in altitude and demonstrate obvious vertical climatic change; these typically include landforms such as high mountains and valleys. The landforms experience frequent natural disasters, with earthquake fracture zones in the high mountains and plateaus, so that the probability of earthquakes is high; and there is also high risk of landslides and mud-rock flow. The environment is ecologically fragile and mostly mountainous; the farmland is scattered and barren, has poor surface permeability, and is prone to severe water and soil loss. The areas have an important ecological function as a source of abundant animals and plants within a number of different ecological systems, and are the important habitat of Chinese rare or endangered animals. Moreover, the land belongs to the important ecological barrier upstream of the Yangtze River. The areas include water resources, nonferrous metal, and nonmetal mineral lamp light resources. They are also the site of intangible world cultural heritage resources and are a popular tourist area.

## Losses Caused by the Earthquake

On May 12, 2008, a devastating earthquake measuring 8.0 on the Richter scale hit Wenchuan County in Sichuan Province. The maximum intensity of the quake reached XI (11) degrees; the quake was followed by over 30,000 aftershocks reaching 48,810 villages in 4,667 towns in 417 counties, cities, or districts of 10 provinces, including Sichuan, Gansu, Shaanxi, and Chongqing. The total affected area and population amounted to approximately 500,000 $km^2$ and over 46,250,000 people (see table 1.2 for casualties). Some 130,000 $km^2$ suffered severe damage; 69,227 people were confirmed dead with another 17,923 missing and 15,100,000 waiting for emergency evacuation and resettlement. The majority of the buildings and the infrastructure collapsed or were otherwise damaged, the area's agriculture and industry suffered great losses, and the natural environment was devastated, all of which resulted in direct economic losses of over Y 845.1 billion. In addition, the quake also triggered an almost unprecedented series of secondary disasters like landslides, debris flows, and dammed lakes.

**Table 1.2** **Wenchuan Earthquake Casualties (selected areas)**

| Area | Dead | Injured | Missing |
|---|---|---|---|
| Wenchuan County | 15,941 | 34,583 | 7,930 |
| Beichaun County | 8,605 | 9,693 | — |
| Mianzhu City | 11,098 | 36,468 | 298 |
| Dujiangyan City | 3,069 | 4,388 | — |
| Guangyuan City | 4,819 | 28,241 | 125 |
| Qingchuan County | 4,695 | 15,453 | 124 |
| Chengdu | 4,276 | 26,413 | — |
| Shifang City | 5,891 | 31,990 | 252 |

Source: Chengdu Daily, May 26, 2009, http://news.jxgdw.com/jszt/512wcddzyzn/zxbd/1060062.html.
Note: – = not available.

## Rescue and Relief Work

The State Administration promptly responded to the earthquake and immediately set up the Command Headquarters for Response to the Wenchuan Earthquake, headed by the premier, as well as 10 working groups that involved the Ministry of Civil Affairs, Ministry of Finance, Ministry of Housing and Urban-Rural Development, Ministry of Transport, Ministry of Public Security, China Banking Regulatory Commission, State Electricity Regulatory Commission, State Post Bureau, Civil Aviation Administration, and State Grid Corporation. Under the leadership of the Command Headquarters, the ministries and institutions listed above broke up the administrative boundaries among different regions, sectors, and military area commands to coordinate mobilization of any possible entity involved in earthquake rescue and relief work.

The rescue and relief work included the following steps: first, to rescue the wounded and ensure the security of the people in the affected areas; second, to organize the delivery of relief materials and ensure the supply of the materials in a timely fashion; third, to get the affected population resettled and ensure the supply of food, clothes, fresh water, and shelter for them; fourth, to look for signs of epidemic diseases in the affected areas and prevent epidemics after the quake; fifth, to send enough medical staff to the most devastated areas to provide medical aid and psychological therapy for the victims; sixth, to make the situation of the disaster better known in more detail and release any relative information as soon as possible.

## Resettlement of Victims

The Victim Service Center of No. 2 Mianzhu Bridge was located beside the No. 2 flyover in Mianzhu City. After the Wenchuan Earthquake, the resettlement site sequentially accepted more than 1, 700 victims from Hanwang, Qingping, Jinhua, and Tianchi, and more than 3, 000 construction workers and more than 300 volunteers from Jiangsu, Hebei, and other provinces.

To facilitate the management of victims, the tents for victims were divided into areas according to the towns of the personnel, and the leaders from the towns were temporarily put in charge of the areas. Drainage ditches were dug around the tents, fire extinguishers were supplied, and garbage disposal sites were set up. Men's and women's latrines were placed among the tents, and a well-organized living area was established (see figure 1. 1).

**Figure 1. 1 Scenes from Victim Resettlement, Mianzhu, July 2008**

Source: Authors.

A large kitchen was arranged in the living area to provide the victims with food, and some victims were assigned the responsibility of cooking. Rice and oil were distributed by the government, and other necessary articles such as meat and vegetables had to be purchased by the resettlement site, paid for out of the victims' living subsidy provided by the government.

A simple supermarket and a temporary medical site were constructed. Medical volunteers from Coal General Hospital and other medical organizations provided simple medical services for the victims and construction workers (see figure 1.2).


**Figure 1.2 More Scenes from Victim Resettlement, Mianzhu, July 2008**

Source: Authors.

Generally, life in the area was orderly. After August 2008, the victims in the area were moved to the prefab houses beside the tents, and the living facility infrastructure was further improved.

# 2

# Methodologies of the Master Report

## The Timeline for the Evaluation

The phase-level evaluation of the recovery and reconstruction work in the postquake areas is contained in one master report and six investigative special topic reports. The Wenchuan Earthquake occurred in May 2008, and the recovery and reconstruction work was launched in September of the same year. Later, the central government determined on the goal of "finishing the three-year reconstruction work roughly within two years" in accordance with the reconstruction work progress.[1] However, as of the beginning of 2011, the reconstruction work was ongoing. The master report's timeline for the evaluation is from September 2008 to September 2011. Because the postquake recovery and reconstruction work constitutes a complex systematic project, it will take a long time to find out how well some components of it – such as industrial reconstruction and "spiritual homeland" reconstruction – are working. Consequently, it is possible that only a phase-level rather than a final evaluation will be conducted.

## The Level and Scope of the Evaluation

The master report evaluation is at the state level, which means it evaluates the overall effect of the recovery and reconstruction work and then sums up experiences and offers lessons for other countries' reference. The investigative special topic reports are at the sector level, and evaluate residential reconstruction, industrial reconstruction, rural reconstruction, and infrastructure reconstruction as well as reconstruction and resettlement outside the disaster areas (off site). Considering the limited duration of the whole project, neither the master report nor the investigative reports evaluate every reconstruction program. The Wenchuan Earthquake hit all the counties of Sichuan, Gansu, and Shaanxi; 39 of the 51 counties affected were located within the boundary of Sichuan. Because Sichuan was hit the hardest, the workforce and capital needed for reconstruction there was accordingly the largest. Thus the master report and the investigative reports mainly focus on evaluating the progress of the recovery and reconstruction work in Sichuan, and discuss the reconstruction work in Gansu and Shaanxi only in part.

## Comparisons in the Evaluation

The evaluation conducts two comparisons,

1 This goal is articulated in the Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction, issued by the State Council in September 2008.

one between the prequake situation and the postquake recovery and reconstruction, and the other between the planned recovery and reconstruction project and its actual implementation.

The first comparison tends to identify the differences in the social and economic development of the stricken areas before and after the earthquake, in terms of people's livelihoods, economic growth, industrial development, and so forth. It assesses the overall effect of the reconstruction work to see in what respects the reconstruction has brought the area back to prequake levels and in what respects it has surpassed past levels and propelled development.

The second comparison, which looks at the projected versus the actual implementation of the recovery and reconstruction planning (both overall planning and specific plans), focuses on residential reconstruction, industrial reconstruction, rural reconstruction, and infrastructure reconstruction, as well as reconstruction and resettlement outside the disaster area. The number of completed projects and the amount (in yuan) of completed-project investment are the major indicators. This comparison is part of the sector-level evaluation.

The two comparisons are conducted through such methods as data comparison, policy analysis, field investigations, and interviews. The comparisons supplement one another, and together, through combined qualitative and quantitative analysis, they shape the mid-term evaluation model for the recovery and reconstruction work (see figure 2. 1).

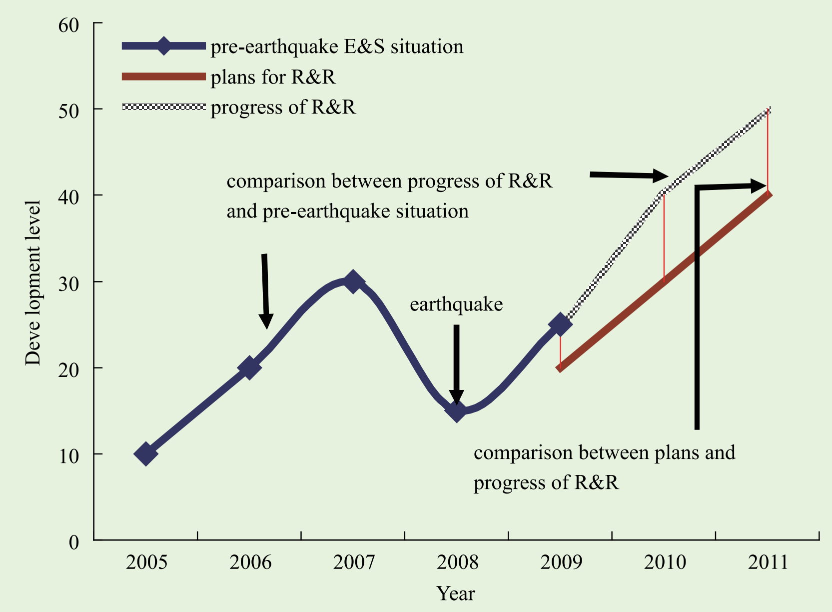


**Figure 2. 1 Two Comparisons in the Master Report**

Source: Authors' representation.

Note: The figure shows the two comparisons carried out in the report – that is, the pre-earthquake situation versus the situation after recovery and reconstruction, and the planned recovery and reconstruction project versus its actual implementation. E&S = economic and social; R&R = recovery and reconstruction.

## Application of the Monitoring and Evaluation System

The monitoring and evaluation (M&E) system was widely employed during postdisaster reconstruction. The monitoring mainly focused on the progress of, and issues related to, the recovery and reconstruction work, while the evaluation was more concerned with the impact of recovery and reconstruction upon social and economic development (see figure 2.2).

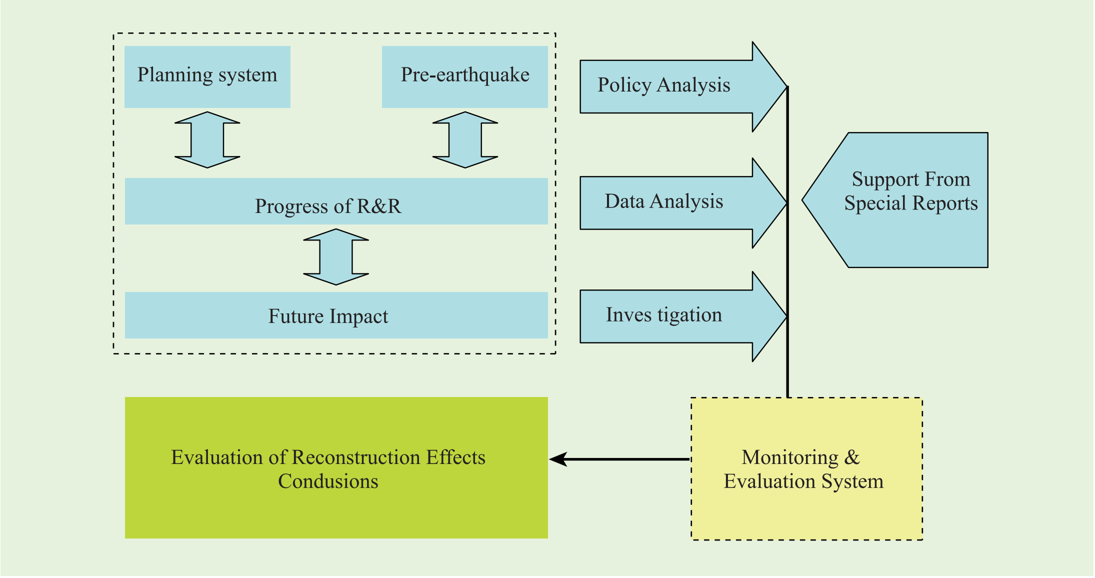


**Figure 2.2 Monitoring and Evaluation System Applied to the Reconstruction Work**

Source: Authors' representation.

Note: R&R = recovery and reconstruction.

An effective monitoring and evaluation system does not evaluate every program. The level and scope of evaluation is critical for the effectiveness of the M&E system. The master report is the mid-term evaluation report at the state level; it draws lessons from the past, so it pays most attention to evaluation and manages to link evaluation and monitoring together. In the case of the residential reconstruction, the master report not only analyzes the completion of the intended work and calculates it as a percentage of the work planned, but also interprets the impact of residential reconstruction upon employment increases, economic growth, cultural protection, and related experiences and lessons. To ensure simplicity, the master report includes both the entity-level output of the recovery and reconstruction project and its mid-term impact upon the social and economic development of the quake-stricken areas. The master report also contains information on monitoring, such as how the objectives of the postquake recovery and reconstruction project were determined, how they were adjusted in response to actual situations, how the overall plan relates to the specific plans, and so forth. The remaining chapters show that the mid-term evaluation led by the central government revised the investment scale to fit the actual demand more precisely, a change that guaranteed completion of reconstruction and saved a great deal in reconstruction funding.

## Relationship between the Master Report and the Investigative Reports

The investigative reports provide supportive information at the sector level for the master report, while the master report summarizes the contents of the investigative reports and draws conclusions at the state level. First, the master report summarizes the common problems mentioned in the investigative reports, including those in residential reconstruction and rural reconstruction, those in the specific plans, and those related to aligning the funds-allocation process. Second, taking into full account the results of the investigative reports, the master report works out a Chinese approach to postquake recovery and reconstruction and suggests its reference value for other countries. Finally, the master report offers a supplementary analysis of those issues not addressed in the investigative reports, such as the overall planning of the recovery and reconstruction project, cultural reconstruction, ecological reconstruction, and so forth.

# 3

# General Progress of Restoration and Reconstruction

## The Chinese Restoration and Reconstruction System

The Chinese government wished to do the work of restoration and reconstruction after the disaster as soon as possible. The assessments of affected areas, which were led by the reconstruction team under the Command Headquarters for Response to the Wenchuan Earthquake, included a loss assessment, geological assessment, and environmental assessment. Scientists from various fields were involved in the assessment work, and advanced technological methodologies, such as remote sensing and aerial photography, were applied. Based on the scientific assessment of the areas affected by the Wenchuan Earthquake, restoration and reconstruction were designed as follows: The Chinese restoration and reconstruction system puts the central government in the leading position, while the local governments, departments, and provinces cooperate with it and are in charge of developing reconstruction work. This is an open system that makes wide use of international aid and various domestic enterprises and nongovernmental organizations to move the reconstruction forward. An overarching fund is disbursed to meet various needs and to promote maximum benefit (see figure 3.1).

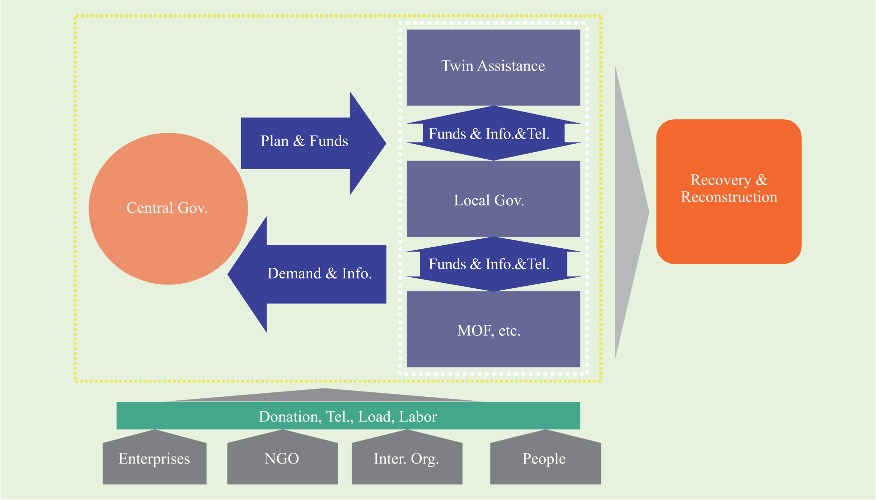


**Figure 3.1 Chinese Approach to Restoration and Reconstruction**

Source: Authors' drawing.

Note: MOF = Ministry of Finance.

**The central government's role in postquake recovery and reconstruction work**

The central government issued principles and guiding opinions for the recovery and reconstruction work. The State Council enacted Regulations on Post-Wenchuan Earthquake Recovery and Reconstruction, which explicitly stipulated the guidelines and principles of the postquake recovery and reconstruction, transitional settlement, investigation and evaluation of earthquake damage, specific planning for the recovery and reconstruction, bodies of liability for reconstruction, and the management and use of reconstruction funds, so as to establish a legal track for recovery and reconstruction. In addition, to ensure that recovery and reconstruction proceed smoothly, the State Council further formulated Guiding Opinions of the State Council on Post-Wenchuan Earthquake Recovery and Reconstruction, which specified the policies and measures for the recovery and reconstruction work. These focus on supporting urban and rural citizens in rebuilding collapsed or damaged houses, public facilities, and infrastructure, and specify an orderly and effective recovery and reconstruction process in order to restore the normal economic and social order in quake-stricken areas. Completion of the main reconstruction tasks was expected to take three years and to bring basic living conditions and economic development in the affected areas up to or beyond prequake levels while laying a solid foundation for sustainable development.

In addition, the central government organized overall planning as well as special plans for recovery and reconstruction. The State Council set up a planning group consisting of over 30 units in a timely fashion. The Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction ("Overall Plan") laid out the arrangements for the recovery and reconstruction as they related to spatial distribution, urban and rural housing, urban construction, rural construction, public services, infrastructure construction, industrial rebuilding, disaster prevention and mitigation, protection of the natural environment, "spiritual homeland" reconstruction, new policies and measures, reconstruction funds, and planning and implementation. The State Council also compiled special plans for distribution of production capacity, land use, recovery of the natural environment, rural construction, and so forth.

Finally, the central government prepared and provided comprehensive assistance to facilitate the smooth implementation of the reconstruction work. After taking into account the changing economic situation throughout the nation and the actual demand for recovery and reconstruction, the central government specified the goal of "finishing the three-year reconstruction work roughly within two years." It provided financial support and tax preference by earmarking funds for recovery and reconstruction, and also provided materials, technology, and human resources. It clarified the responsibilities of all departments, including development and reform, finance, civil affairs, and construction, and at the same time encouraged civilians, business entities, and other organizations to donate money or materials for the recovery and reconstruction work. The government accepted all kinds of aid necessary for reconstruction from foreign governments and international organizations and delivered them to the quake-stricken areas as soon as possible; it also double-checked ground motion parameters, seismic resistance requirements, and engineering construction standards in the areas; evaluated the reconstruction projects to ensure they met seismic resistance requirements; and organized a mid-term evaluation of and adjustments to the recovery and reconstruction planning.

**Local governments' role in carrying out recovery and reconstruction work**

Local governments established a series of supportive systems that matched with overall plans in the interest of getting those plans implemented. Sichuan Province set up a provincial reconstruction planning group for relief work under the Command Headquarters, and – with the aim of helping the state to finish overall planning and 10 special plans – it completed 43 industrial plans, 51 implementation plans for severely damaged counties, cities, or districts, and 88 project plans for less-damaged counties, cities, or districts. All these helped to create a recovery and reconstruction planning system with clear objectives, levels, and scales. To ensure that recovery and reconstruction work proceeded smoothly and as planned, every quake-stricken city, county, and department concerned formulated an annual implementation plan to make clear the construction progress and strengthen supervision and inspection.

Local governments also established a complete and aligned system of laws, regulations, and supportive policies. The Standing Committee of Sichuan People's Congress reviewed and approved the Decision about Supportive Family Planning Policy to the Families Whose Children Were Maimed or Lost in the Wenchuan Earthquake Disaster. The provincial government also issued Regulations on Cleanup and Protection of the Earthquake Sites and the Sites of the Like Disasters in Beichuan Qiang Autonomous County, and Opinions on Safety Checking, Renewing, and Demolishing the Damaged Urban Housing in the Wenchuan Earthquake-Stricken Areas. It issued other prescriptive documents as well, including technical guidance on selecting sites for buildings to be reconstructed, and opinions on safety checking and on renewing and demolishing damaged urban housing. These regulations in combination successfully led the recovery and reconstruction work onto a legal track. Based on the policies issued by the state, and taking into consideration the actual reconstruction situation, Sichuan Province specifically formulated 47 supportive policies (related to finance, taxation, industry, and employment) to facilitate the recovery and reconstruction work and make full use of available policy resources.

In addition, local governments mobilized and united institutions and individuals available to carry out the recovery and reconstruction work. Sichuan Province established the Postdisaster Reconstruction Council to make unified arrangements for the recovery and reconstruction work; the local governments of the quake-stricken areas also set up panels of experts in architecture, engineering, and information technology for technical guidance, and sent the professionals to the devastated areas as first responders; the local government also divided the recovery and reconstruction tasks, tracked the progress of all projects, and supervised and examined the recovery and reconstruction work from beginning to end.

Finally, local governments raised and rationally allocated reconstruction funds. Because there was a shortage of reconstruction funds, the Department of Finance of Sichuan Province converted most of the newly available financial resources into the provincial reconstruction fund, and local governments in affected areas also used these resources for recovery and reconstruction, with departments of finance at different levels optimizing expenditure structures to save money for the reconstruction. Meanwhile, more funds were raised from donations by markets, from bank loans, and from investments civil society organizations; local governments also decided to raise funds by issuing local government bonds, financial bonds, and short-term financing bonds and by establishing financing platforms with complete market-operation mechanisms. In addition, a social participation mechanism was established through self-construction, construction supported by organizations, a welfare-to-work approach, and a build-operate-transfer (BOT) approach; the mechanism aimed at the overall balance of reconstruction funds. During the recovery and reconstruction work, departments of finance at different levels always gave priority to livelihood projects. For example, there were about 69 credit guarantee companies involved in the reconstruction of the three affected provinces. With special funds for earthquake recovery from the government, they helped companies restart production.

**Establishment of a "twin assistance" mechanism**

The State Council formulated the Outline of Twin Assistance in Recovery and Reconstruction following the Wenchuan Earthquake. The twin assistance mechanism, which paired affected counties with a donor province responsible for offering financial aid (1 percent of annual income) and other aid, tended to rationally allocate resources in accordance with the economic strength of donor provinces and the degree of damage in the recipient counties. It also served to organize provinces and municipalities to provide one-to-one assistance to the quake-stricken areas in order to accelerate progress in recovery and reconstruction.

According to the requirements of the Overall Plan, donor provinces (or province-level municipalities) were expected to provide no less than 1 percent of their annual local budgetary revenue to assist 24 counties in Sichuan, Gansu, and Shaanxi. The contents and forms of twin assistance also included the following: compilation of planning, architectural designs, expert consultation, and engineering construction and supervision; building and repairing urban and rural homes; building and repairing public facilities like schools, hospitals, radio and television infrastructure, and facilities for cultural and sporting events as well as public welfare; building and repairing infrastructure like urban and rural roads, water supply and drainage, gas supply, sewage treatment, and garbage disposal; building and repairing infrastructure for farms and villages; providing mechanical equipment, instruments, and building materials; selecting and sending teaching faculty and medical professionals; providing personnel training, reception services for foreign students, labor input and output, and agricultural technology; and encouraging enterprises to invest in building plants and market service facilities such as supermarkets in accordance with the mode of market operation, and to participate in the operational infrastructure construction.

**Rational allocation and use of reconstruction funds**

The use of funds was specified as follows: Funds were earmarked for urban and rural homes, resettlement of the affected population, public services, municipal public facilities, infrastructure for public interests, the agricultural service system and rural community infrastructure, logistics infrastructure, disaster prevention and mitigation, ecological restoration, environmental remediation, land consolidation and reclamation, reconstruction of the "spiritual homeland," and capital supplement and interest subsidy for loans. "Twin assistance" funds were mainly used for urban and rural homes, public services, municipal public facilities, the recovery and reconstruction of agricultural and rural infrastructure, and the compilation of planning, architectural designs, expert consultation, and engineering construction and supervision. Donations were to go mainly to the recovery and reconstruction of urban and rural homes, schools, hospitals, facilities for culture and public welfare, rural roads and bridges, earthquake relics and relevant facilities, nature reserves, cultural and natural heritage, and the spiritual homeland. Credit funds were expected to focus on the recovery and reconstruction of urban and rural homes and agricultural production bases and to rebuild infrastructure and other requirements for transportation, telecommunications, energy, industry, tourism, commercial trading, cultural industries, and agriculture. The funds raised from capital markets were for the recovery and reconstruction of infrastructure and other requirements for transportation, telecommunication, energy, industry, tourism, commercial trading, and cultural industries. Concessional emergency loans from abroad were earmarked for the recovery and reconstruction of urban and rural public facilities and infrastructure, low-rent housing, ecological restoration, and environmental remediation.

Recovery efforts took full advantage of the leverage effect of financial funds. The Ministry of Finance set up the postearthquake recovery and reconstruction funds (PERRF) along with a timely appropriation mechanism, and it adopted the method of "the overall arrangement together with the classified control" to rationally allocate the funds. This meant that the reconstruction funds were allocated to the three quake-stricken provinces in accordance with 10 different classifications (for example, urban and rural homes) and that the three provinces allocated the funds to the counties in need. Governments at all levels were supposed to use the reconstruction funds to maximize their service efficiency; they were also to set up special guarantee funds to provide guarantees for housing reconstruction loans issued by financial institutions to poor families in rural areas, since these guarantees would attract more credit funds to invest in the reconstruction work. Information concerning the reconstruction funds (budgets as well as appropriation) was made public at the start. Officers from the Ministry of Finance were sent to affected areas specifically to monitor both the fulfillment of reconstruction projections backed by fiscal funds and the execution of the fiscal budget. However, the greatest challenge encountered in managing the funds was the collection of reconstruction funds by local governments; this challenge was addressed by reducing general executive expenditures (that is, eliminating expenses such as conferences and official cars).

In order to enlarge the scope of value-added-tax deductions in quake-stricken areas, to reduce administrative charges, and to provide subsidies for urban housing reconstruction, imported relief materials were exempted from taxes, and loans for postquake reconstruction enjoyed a financial discount from the central government.

By the end of September 2010, the PERRF had offered Wenchuan County Y 4, 229. 8 million; reconstruction of industry accounted for 24. 7 percent of this amount, housing reconstruction for 14. 5 percent, and infrastructure reconstruction for 10. 8 percent. By this same time, Wenchuan County had raised Y 6, 880 million in reconstruction funds through enterprise self-funding, personal self-funding, and financial markets.

**Mobilization for participating in postquake reconstruction**

Under the principle of "combining the leadership of the governments with social participation," all societal groups were mobilized to participate in postquake industrial, cultural, ecological, and psychological reconstruction. Enterprises, individuals, nongovernmental organizations, and social communities were encouraged to donate money, relief materials, or technical assistance, and volunteers were organized to carry out reconstruction work in the quake-stricken. Finally, once the affected population was resettled, it too was mobilized and organized to carry out reconstruction work and raise funds.

**Positive use of international aid for postquake recovery and reconstruction**

Positive use was made of all forms of international aid. Donations from international organizations such as the World

Bank, Bank of Asia, and Global Environment Facility were used to purchase reconstruction materials, perfect emergency systems, improve disaster prevention and mitigation capabilities, measure damage caused by seismic disasters, and conduct research on preventing and handling natural disasters.

Domestic loans from the World Bank and the Asian Development Bank, including emergency recovery loans and loans for ongoing construction projects, focused on livelihood issues and addressed infrastructure recovery and poverty alleviation.

There was a commitment to learning from postdisaster recovery and reconstruction experiences of foreign countries, to accepting guidance from international organizations like the World Bank, and to participating in the personnel or technical training on disaster prevention and mitigation initiated by international organizations.

## Achievements in Restoration and Reconstruction

The Wenchuan Earthquake was the most destructive earthquake in China since 1949, with widest scope and severest losses. Since the formal work of restoration and reconstruction began and the requirement of completing the three-year task in two years was agreed to, all the parties involved have cooperated, and the work of reconstruction has achieved some crucial victories: the condition of the disaster area is greatly changed for the better, people's livelihoods have improved, and the capacity for economic development has increased. By the end of September 2011, all of the 41, 130 reconstruction projects had been started, and 40, 890 projects had been completed, for a completion rate of 99. 42 percent. The Y 949. 61 billion invested represents 99. 1 percent of the total planned investment, with Sichuan, Gansu, and Shaanxi respectively accounting for Y 856. 847 billion, Y 62. 249 billion, and Y 30. 514 billion, and the investment sums respectively accounting for 98. 96 percent, 101. 25 percent, and 98. 67 percent of the investment planned for each area.

### Improvements in living conditions

Housing is the most crucial aspect of restoration and reconstruction. Repair and consolidation of damaged houses had been completed one year after the earthquake. Within one and a half years, the reconstruction of rural housing had been completed, and within two years, the reconstruction of urban housing had been basically completed. Housing is no longer a problem for people in the disaster area. At the end of September 2011, Y 83. 463 billion and Y 178. 431 billion had been invested in urban and rural housing respectively; these represent 99. 52 percent and 101. 16 percent respectively of the planned investment in rural and urban residential reconstruction.

In the disaster areas across the three affected provinces, 2. 92 million rural houses and 1. 46 million urban houses had been repaired and consolidated. In addition, 1. 91 million rural houses and 0. 29 million urban houses had been reconstructed. Urban living conditions had obviously improved over what they were before the earthquake: the housing layout is more logical, the city functions have been extended, and the supporting facilities are more complete. The housing is safe, attractive, economical, and practical; and many rural houses are now connected with a water supply – residents can use tap water – and houses have drainage facilities. For occupants of this housing, living conditions have markedly improved.

### Reconstruction of Yingxiu

By the end of September 2011, 1, 102 construction projects in the town system had been completed; this represents 95. 83 percent of the total number planned. By this same time, Y 96.415 billion had been invested, which represents 97.79 percent of the planned investment. Thirty-eight towns were reconstructed; notably, the newly reconstructed town of Yingxiu successfully withstood a torrential flood and mud-rock flow in August 2010. It is now the model for disaster prevention and relief.

### Rural reconstruction

By the end of September 2011, 1,842 of 1,850 planned rural projects had been completed, and Y 57.513 billion had been spent; this figure represents 99.9 percent of the planned investment. Villages are no longer laid out in a disorderly or haphazard fashion. Depending on which industries are dominant in each village (tourism, agriculture, and so on), the designs offer specific advantages.

### Improvement in public service facilities

By the end of September 2011, the accumulated sum of Y 108.283 billion had been invested in public service facilities; this represents 98.55 percent of the planned investment. Education projects, medical sanitation projects, and social management projects are responsible respectively for Y 43.908 billion, Y 16.121 billion, and Y 18.603 billion; these figures represent respectively 40.54 percent, 14.89 percent, and 17.18 percent of the planned investment in public service facilities. Ruined schools and hospitals have been fully restored and reconstructed, and old-age homes, community centers, villager activity centers, and other public service facilities have been established. The antiseismic standard for schools and hospitals was increased to grade 8 from grade 7. The buildings are more stable and safer, and the facilities and equipment are also obviously improved. The newly constructed schools have spacious and bright classrooms, clean and orderly dorms, and high-quality laboratories, libraries, and playgrounds. Public service capacity in the disaster area has obviously increased, and the equalization level for basic public services is near the top for western China.

### Restoration of basic facilities

By the end of September 2011, all of the 5,059 planned basic facility projects had started; 3,690 had been completed. The sum of Y 206.702 billion had been invested; this represents 98.22 percent of planned investment. Spending on traffic, communication, energy, and water conservancy has been, respectively, Y 131.608 billion, Y 18.638 billion, Y 35.286 billion, and Y 21.17 billion; the sum for communication represents 100 percent of planned investment; for each of the others, the share is over 97 percent. Basic facilities for traffic, communication, energy, water conservancy, and so forth were fully restored and are functioning. Many of these important projects involving basic facilities will provide a firm foundation for long-term development of the disaster area.

### Optimization and upgrading of industry through reconstruction

By September 2011, all of the 5,333 projects relating to industrial production, layout, and regulation had started, and a total of Y 147.299 billion invested; this figure represents 100.03 percent of the planned investment. The enclave mode, the off-site industrial park mode, the "twin assistance" industrial park mode, and other modes have been creatively adopted in the restoration and reconstruction of industry, and industrial development has been speeded up and industry upgraded as a result.[1]

The enterprises ruined in the earthquake have

1 The off-site industrial park mode is explained more fully in chapter 8. The "twin assistance" industrial park mode involves construction of industrial parks with the aid of donor provinces.

been restored, and their capacity and sales volume have reached new highs. As a result of improvements to industry, outdated facilities are no longer used; instead, industrial parks and clusters are in operation. The facilities for agricultural production and the agricultural service system have been fully restored, and production bases for characteristic agricultural products have been constructed. Economic development and the improvement of industrial regulation and industrial layout have been achieved together.

**Increased capacity for disaster prevention**

By the end of September 2011, all 1, 304 planned disaster-prevention projects had started, and 855 projects had been completed. The total sum invested was Y 147. 299 billion; this represents 93. 05 percent of the planned investment. Work thus far has improved the ability of the affected area to prevent geological disasters.

**Environmental improvement**

Great efforts were made to repair the natural environment damaged by the earthquake. At the end of September 2011, all of the ecological restoration and environmental control projects had started, and 605 projects, or 81. 21 percent of the number planned, had been completed. By repairing the natural environment, further disasters – those that might be caused by initial damage to the area – can effectively be avoided.

**Protection and diffusion of culture**

During restoration and reconstruction, efforts were made to preserve the affected area's national culture; the goal was to create a "spiritual homeland" for the people in the disaster area.[2] Work on all 92 spiritual homeland sites has started, and 16 sites have been completed; the investment has been Y 1. 236 billion, which represents 84. 6 percent of the total planned investment. Among the completed projects are two Dujiangyan museums, the Mianzhu new-year picture village, the An County culture center, Jiangyou Libai Memorial Hall, and the Jianchuan Earthquake Museum. The main engineering tasks are complete for the Beichuan Qiang folk museum.

Under the twin assistance mechanism, doctors from outside the affected areas have provided psychological services for affected people. Moreover, psychologists from affected provinces received training at hospitals in their counterpart ( twin assistance ) province to help them aid earthquake victims.

2 As explained in the Overall Plan, the spiritual homeland refers to a series of sites for memorials and museums as well as mental health services for victims.

# 4

# Evaluation of Housing Restoration and Reconstruction Progress in Urban and Rural Areas

## Loss of Urban and Rural Housing

It is estimated that the loss of or damage to urban and rural housing in quake-stricken areas affected 5, 130, 000 households; 2, 910, 000 households had their homes severely damaged or entirely destroyed. The affected housing in urban areas covered 110, 000, 000 $m^2$ and involved 1, 255, 600 households; 720, 300 households suffered severe damage to or entire destruction of their homes. In rural areas, the affected housing included 15, 741, 600 rooms occupied by 3, 872, 300 households; 2, 188, 700 households suffered severe damage to or entire destruction of their homes.

## Goals of the Urban and Rural Restoration and Reconstruction Program

The fundamental goal of the postquake urban and rural restoration and reconstruction program was twofold: to provide shelter for the affected population in a timely fashion, getting it back to at least the prequake level; and then more gradually to improve the living environment by building high-quality, safe housing, providing better public services to communities, establishing emergency shelters in case of natural disasters, and making use of energy-efficient and environmentally friendly technologies.

The midterm evaluation adjusted the goals of the restoration and reconstruction program as follows: to build new housing for 1, 908, 500 rural households (originally 2, 188, 700) and 29, 500 urban households (originally 720, 300); and to repair and consolidate housing for 2, 921, 400 rural households (originally 1, 683, 600) and 1, 456, 200 urban households (originally 47, 129, 900 $m^2$). This adjustment took place as a result of monitoring under the M&E system. It is summarized in table 4. 1

**Table 4. 1 Goals of Housing Reconstruction after Mid-Term Adjustment**

| | Type | Total (tens of thousands) | Sichuan (tens of thousands) | Gansu (tens of thousands) | Shaanxi (tens of thousands) |
|---|---|---|---|---|---|
| Urban housing | Repair | 145. 62 | 135. 22 | 5. 88 | 4. 52 |
| | Reconstruction | 29. 05 | 25. 93 | 2. 03 | 1. 09 |
| Rural housing | Repair | 292. 14 | 228. 56 | 39. 46 | 24. 12 |
| | Reconstruction | 190. 85 | 148. 51 | 30. 2 | 12. 14 |

Source: Postdisaster Restoration and Reconstruction Office.
Note: Total is for Sichuan, Gansu, and Shaanxi combined.

**Technologies applied in the restoration and reconstruction program**

In compliance with the State Standard for Grade Classification of Earthquake Damage for Buildings and Special Structures and the specific requirements of seismic resistance determined by local authorities, the plan for urban and rural housing restoration and reconstruction released by Sichuan Province divided housing into three types depending on whether they needed reconstruction, consolidation, or repair.

Site selection for reconstruction had to coordinate a range of concerns, including the ties and connections of the population being resettled, the demands of disaster site clearance and production recovery, the need for both rural and urban housing to be supported by a disaster prevention and mitigation system, the connection of appropriate population aggregation to disaster prevention, the choice between reconstruction on site or nearby; and any conflicts between short-term recovery work and long-term development in the quake-stricken areas.

**Quality standards for housing reconstruction**

The quality standards for newly built housing were as follows: houses should be away from seismically active faults, areas of ecological vulnerability, and areas where serious engineering or hydrogeological disasters could occur; houses should be planned, designed, built, and accepted in accordance with the locally amended requirement of antiseismic intensity; they should remain intact in small earthquakes, be largely reparable in moderate earthquakes, and not collapse in big earthquakes; and they should not depart from design documents or the reconstruction program's mandatory standards.

Standards for consolidated housing were as follows: the traditional housing features and architectural style should be preserved; the consolidated houses should meet the current national seismic fortification criterion and the project quality criterion; and the consolidation work of rural housing should be implemented under a specific consolidation plan and with technical assistance from professionals arranged by the local government.

**Funding for housing reconstruction**

Funding for housing reconstruction was accomplished through self-construction, tax reduction, the twin assistance mechanism, charitable contributions, domestic bank loans, and foreign preferential emergency loans, as well as from some other sources.

## Significant Achievements of the Housing Reconstruction Program

**Main goals met and the living environment improved**

As of the end of September 2011, the urban and rural housing reconstruction program had been carried out in accordance with the schedule of the Overall Plan (see table 4.2). The plan was adhered to in terms of projects begun, projects completed, and use of the investment fund, which amounted to Y 83.463 billion for urban housing and Y 178.431 billion for rural housing, or 99.52 percent and 101.16 percent respectively, of the planned investment. In the three affected provinces, housing was consolidated under the program for 2,920,000 rural and 1,460,000 urban households; reconstructed housing was undertaken for 1,910,000 rural and 290,000 urban households.

The completion of the reconstruction program has significantly contributed to the recovery of production and living conditions for affected populations, has improved livelihoods in the affected areas, and has increased both social stability and the development of local economies. According to questionnaires administered in the affected

Table 4. 2 **Housing Reconstruction as of End-September, 2011**

| Area | Type | Number of projects started (tens of thousands) | Projects started as share of planned projects (%) | Number of projects completed (tens of thousands) | Projects completed as share of planned projects (%) | Actual investment (hundred million yuan) | Actual investment as share of total planned investment (%) |
|---|---|---|---|---|---|---|---|
| Urban | Repair | 145. 68 | 100. 04 | 145. 68 | 100. 04 | 834. 63 | 99. 52 |
| | Reconstruction | 29. 12 | 100. 24 | 29. 02 | 99. 90 | | |
| Rural | Repair | 292. 14 | 100. 00 | 292. 14 | 100. 00 | 1, 784. 31 | 101. 16 |
| | Reconstruction | 190. 85 | 100. 00 | 190. 85 | 100. 00 | | |

areas, 70 percent to 80 percent of the affected population reported that the restoration and reconstruction program improved their living environment.[1] The analysis also showed that home appliances like solar water heaters, television sets, telephones, and refrigerators were installed in the reconstructed houses upon completion (see figure 4. 1 and 4. 2).

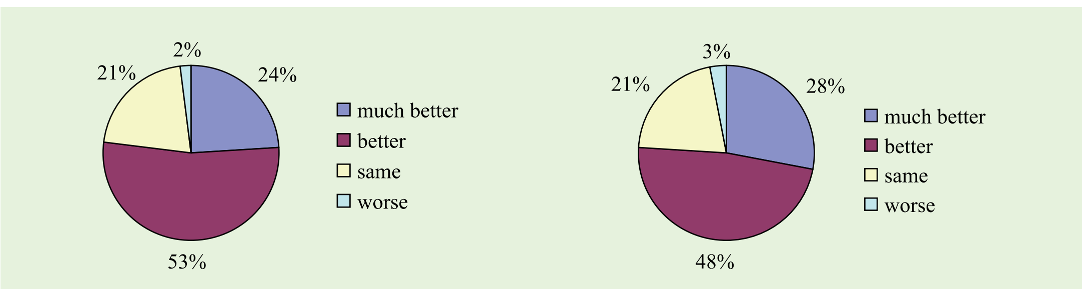


**Figure 4. 1 Residents' Assessment of Living Environment after Reconstruction in Rural Areas (left) and Urban Areas (right)**

Source: Adapted from questionnaire administered in conjunction with *Investigative Report on Reconstruction of Urban and Rural Housing.*

**Figure 4. 2 Home Appliances in Reconstructed Houses, February 2010**

Source: Authors.

1 The evaluation methodology of which the questionnaires were a part is explained in the special reports on rural reconstruction and reconstruction of urban and rural housing.

**Connection of the housing reconstruction, employment increase, and industrial development**

The implementation of the reconstruction program, coupled with the impact of the global financial crisis, brought migrant workers to the reconstruction team. The fixed-asset investment of Y 1, 200 billion in Sichuan Province has created over 400, 000 jobs. In the affected areas, housing reconstruction and the development of specialized economies were closely connected. For instance, some areas have taken advantage of the natural environment to develop a tourism industry. Tourism in the affected areas has in fact become a significant industry and has boosted the development of local economies (see figure 4.3). The economy of Shuimo, for instance, used to be based on leather processing, an industry that produces serious pollution; following reconstruction, its economy has been based more on tourism, a change that represents an environmental improvement. Finally, the higher incomes and expanded opportunities for employment brought about by reconstruction have improved relationships within communities.

**Figure 4.3 Tourism Sites in Yingxiu (left) and Shuimo (right), February 2010**

Source: Authors.

**Reconstructed housing's high safety standards**

In the wake of the earthquake, the Code for Seismic Design of Buildings was issued. The code strengthens the antiseismic intensity of homes, hospitals, schools, and other buildings, and specifies required standards of design, construction, and inspection. To offer technical guidance in rural housing reconstruction, the Housing and Urban – Rural Development Department of Sichuan Province formulated and issued 14 guidance documents and technical regulations. It also compiled two atlases that address rural housing reconstruction and specifically antiseismic rural construction; these offer over 300 housing designs to choose from. The survey analysis showed that 70 percent to 80 percent of the affected population received at least some technical guidance in the reconstruction process (see figure 4.4).

**Urbanization as a function of housing reconstruction**

During the restoration and reconstruction process, affected areas increased their rate of urbanization. They actively reformed institutional systems, optimized resource allocation, strengthened infrastructure, and improved urban functions, all of which changes are expected to further improve the urban environment, facilitate comprehensive urban services, and highlight the overall bearing capacity and radiation capacity of cities. These changes are important as city

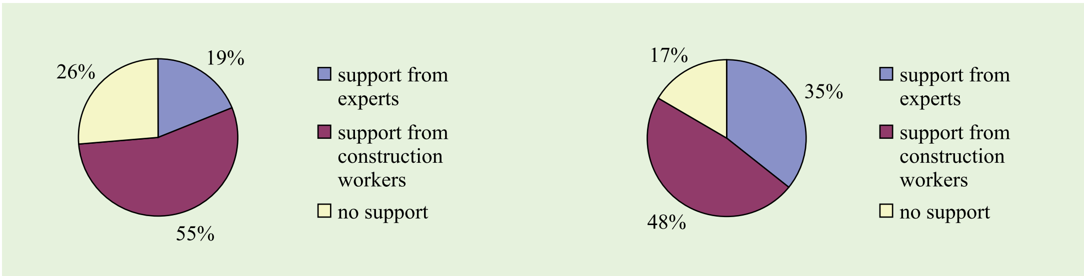


**Figure 4. 4  Technical Guidance Received by Rural Residents (left) and Urban Residents (right)**

Source: Adapted from questionnaire administered in conjunction with *Investigative Report on Reconstruction of Urban and Rural Housing*.

centers are further extended, urban cultural tastes are spread further, and urbanization continues to grow. All the affected counties actively carried out an urban-rural integration strategy by accelerating construction for the collective resettlement of communities and by installing necessary support facilities. The reconstruction planning charts of Beichuan and Yingxiu make clear that the urban facilities were relocated in an orderly fashion, with needed infrastructure near the residences, industrial buildings sited far way, and space reserved for future development (see figure 4. 5).

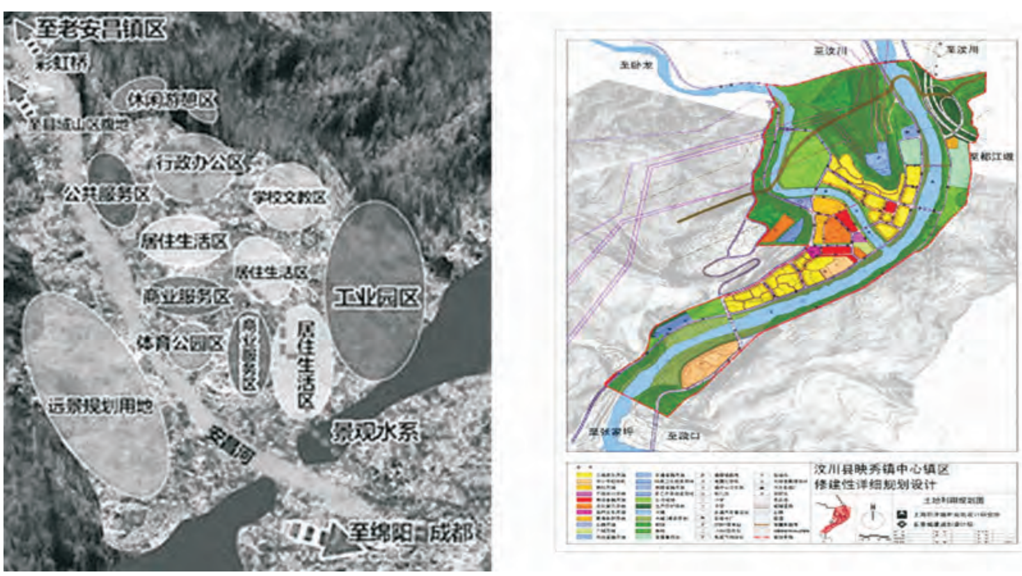


**Figure 4. 5  Reconstruction Planning Charts for Beichuan (left) and Yingxiu (right)**

Source: http://news. jxgdw. com/jszt/512wcddzyzn/zxbd/1060062. html.

Note: The chart for Beichuan shows residences, businesses, and public service facilities clustered in the center, with industry (large oval on the right) and the area for future development (large oval on the left) on the outskirts. The chart for Yingxiu shows residential areas (yellow) located near public service facilities (red) and businesses (purple).

### Preservation of traditional ethnic cultures in housing reconstruction

A sizable population of ethnic minorities lives in the quake-affected areas, mostly members of the Zang and Qiang peoples. During the reconstruction work, the architects did research aimed at ensuring that houses' architectural façades were in keeping with cultural and ethnic practices (see figure 4.6). This was done to avoid any discrimination against minorities in housing reconstruction and to ensure that minorities could live in traditional houses; local governments and construction enterprises were required to provide such housing. Regulations on Post-Wenchuan Earthquake Recovery and Reconstruction stipulate that local minorities approve home designs.

**Figure 4.6 Villages of Qiang Ethnic Minority in Beichuan (left) and Wenchuan (right), August 2011**

Source: Authors.

## Experiences of Housing Reconstruction Based on Case Studies

### Case 1: Rural housing reconstruction in Qingping of Mianzhu City

The rural construction work in Qingping demonstrated three principles that characterize a Chinese approach to reconstruction work: "three respects" (respect for science, nature, and people's preferences), "three aways" (away from seismically active faults, from ecological vulnerability, and from flood channels), and "one ensure" (ensure people's safety). Rural housing in Qingping was designed by the Sichuan Institute of Urban Planning and Design in compliance with the overall requirement that new village construction offer "appropriate population aggregation, strong industrial support, complete functional facilities, a harmonious living environment, and scientific management."[2]

The rural housing reconstruction site of Linjiakan, for instance, was located at No. 2 Yuantong Village of Qingping, near the township; thus infrastructure, public facilities, and productive services were easily accessible, which both lowered construction costs and improved living conditions in the new village. Resettlement of the rural population was implemented through "overall planning by the government and self-construction by the individuals" – that is, the government broke through administrative divisions and organized the affected population to voluntarily select resettlement sites from various safe places across the town. Groups of eight households voluntarily formed housing reconstruction committees, which then negotiated with eligible enterprises offered by the government and with whom

2 The language is from Planning of Postdisaster Urban and Rural Housing Restoration and Reconstruction, issued by the State Council in October 2008.

they contracted for the housing reconstruction. The Construction Administration Department supervised the quality and security of the whole housing reconstruction process as the supervision unit.

**Case 2: "Portfolio reconstruction" in Longtanwan community in Dujiangyan**

Longtanwan has a variety of housing types – houses built and owned by peasants, houses built by industrial enterprises and owned by workers, and houses built by real estate enterprises – and this diversity made it difficult for residents there to reach an agreement on the reconstruction plan. Accordingly, the local authorities investigated the housing situation, heard people's preferences and ideas, and then suggested an approach that might be suitable: community divisions might be overcome by altering the layouts of the original sites in accordance with the overall reconstruction plan and the spirit of municipal reconstruction policies. This "portfolio reconstruction" model is useful where residents cannot agree upon a style and has been influential across the city. This model is people oriented and at the same time adheres to scientific planning principles; it also demonstrates flexibility – the idea of the "right crop for the right time, right place, and right situation." This reconstruction is now a demonstration site and is significantly contributing to further restoration and reconstruction work in Dujiangyan.

**Experiences of the housing reconstruction program**

Six experiences were particularly important in the housing reconstruction program:

(1) Resettlement and livelihood come first in the reconstruction work. Housing is the foundation of resettlement and a necessity for livelihood. The Overall Plan for Post-Wenchuan Recovery and Reconstruction circulated by the State Council required that "the reconstruction work be people-oriented and take people's livelihood as the starting point," and that it "give top priority to housing restoration and reconstruction," with "one house for every family" the primary goal of the reconstruction planning.

(2) Scientific planning should guide the reconstruction work and regional development. The Planning of Postdisaster Urban and Rural Housing Restoration and Reconstruction was one of the earliest planning documents formulated. Scientific planning ensured that new houses were built in safe areas (this point is discussed in detail in chapter 8).

(3) The reconstruction work proceeds smoothly when funding is smooth. The reconstruction fund came from various channels, including government subsidy, self-financing, preferential loans, and relief funds for poor families, which effectively solved the monetary demand for the housing reconstruction. Because of the smooth funding mechanism, materials required for housing reconstruction were transported and distributed on time.

(4) The reconstruction work is people centered, and people's preferences are respected. The affected population should be the main consideration as the work is carried out. Various reconstruction models were adopted to meet different people's preferences. Socioeconomic differences were acknowledged and managed in housing reconstruction (this point is discussed in chapter 6, which deals with reconstruction of poor villages).

(5) The people-oriented approach ensures safe construction. Site selection in affirmatively safe places avoided potential future disasters; strengthened management of the construction process guaranteed the quality of the project; and technical regulations concerning rural

housing reconstruction meant that for the first time in a thousand years, rural housing was being constructed to meet seismic standards.

(6) Pleasant living environments have a positive influence on people's livelihood. Postquake reconstruction meant not simply recovery, but development and improvement. Reconstruction afforded an opportunity to substantially change the way of life and living conditions in urban and rural areas.

# 5

# Evaluation of Progress in Public Service Facility and Infrastructure Restoration and Reconstruction

## Loss of Public Service Facilities and Infrastructure in Affected Areas

The Wenchuan Earthquake seriously damaged public service facilities and infrastructure. It knocked down buildings in an area of over 40 million $m^2$, and destroyed more than 500,000 devices and pieces of equipment used by public service facilities. There were 7,444 schools affected in an area totaling over 19,550,000 $m^2$; and 11,266 medical institutes and 54,745 medical devices were destroyed in area of 4,850,000 $m^2$.

The direct economic loss of the infrastruc-ture in the affected areas came to Y 107.006 billion. Transportation (including railway and civil aviation) made up Y 57.898 billion of this amount, telecommunications (including postal service) Y 7.087 billion, energy Y 17.692 billion, and water treatment Y 24.329 billion (see table 5.1).

**Table 5.1 Economic Loss of Public Service Facilities and Infrastructure Caused by Wenchuan Earthquake**

| Projects | Total | Sichuan | | Gansu | | Shaanxi | |
|---|---|---|---|---|---|---|---|
| | Economic loss (hundred million yuan) | Economic loss (hundred million yuan) | Loss as share of total (%) | Economic loss (hundred million yuan) | Loss as share of total (%) | Economic loss (hundred million yuan) | Loss as share of total (%) |
| Municipal public facilities | 439.48 | 424.8 | 96.66 | 12.00 | 2.73 | 2.68 | 0.61 |
| Transportation | 873.88 | 764.38 | 87.47 | 92.63 | 10.60 | 16.87 | 1.93 |
| Water conservancy and electricity | 469.77 | 430.22 | 91.58 | 24.85 | 5.29 | 14.70 | 3.13 |
| Education system | 46.76 | 40.74 | 87.12 | 5.41 | 11.57 | 0.61 | 1.31 |
| Medical system | 17.34 | 15.89 | 91.64 | 0.96 | 5.54 | 0.49 | 2.82 |

Con.

| Projects | Total | Sichuan | | Gansu | | Shaanxi | |
|---|---|---|---|---|---|---|---|
| | Economic loss (hundred million yuan) | Economic loss (hundred million yuan) | Loss as share of total (%) | Economic loss (hundred million yuan) | Loss as share of total (%) | Economic loss (hundred million yuan) | Loss as share of total (%) |
| Cultural system | 27.24 | 25.9 | 95.08 | 0.88 | 3.23 | 0.46 | 1.69 |
| Environmental protection system | 26.18 | 25.4 | 97.02 | 0.38 | 1.45 | 0.40 | 1.53 |
| Government facilities | 53.57 | 44.76 | 83.55 | 4.01 | 7.49 | 4.80 | 8.96 |
| Cultural heritage | 89.66 | 84.2 | 93.91 | 3.95 | 4.41 | 1.51 | 1.68 |

Source: Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction (State Council, September 2008).

Note: Total is for Sichuan, Gansu, and Shaanxi combined.

## Goals of Public Facility and Infrastructure Reconstruction

### Public facility reconstruction

The goal of public facility reconstruction was to complete the main tasks within three years, guarantee the accessibility of basic public services and facilities to residents, and both quantitatively and qualitatively improve public services in the affected areas over prequake levels. Public facility reconstruction focused on the following 11 areas:

(1) Education. Reconstruction of educational facilities was concentrated on primary and secondary schools and kindergartens. The various schools to be restored and reconstructed totaled 4,810; the work affected 3,330,000 students. There were 264 kindergartens to be reconstructed; the rebuilding area covered 438,300 $m^2$ and the consolidating space 77,500 $m^2$. Sixty-two other educational institutions needed to be restored and reconstructed.

(2) Medical care. The reconstruction of medical facilities involved 90 construction projects at general hospitals, whose building area totaled 1,300,300 $m^2$; 51 construction projects at hospitals practicing traditional Chinese medicine, whose building area totaled 390,500 $m^2$; 28 construction projects at specialized hospitals, whose building area totaled 101,000 $m^2$; 1,263 construction projects at clinics in towns and villages, whose building area totaled 1,825,200 $m^2$; and 239 construction projects at other health care institutions, whose building area totaled 588,800 $m^2$.

(3) Family planning. The reconstruction of family planning was mainly concentrated on the 66 family planning service centers run by the county, of which 58 needed to be reconstructed and the remaining 8 needed to be consolidated and repaired; and 348 family planning service stations run by the township, of which 278 needed to be reconstructed and the remaining 70 needed to be consolidated and repaired.

(4) Culture. Reconstruction of cultural facilities involved the restoration and reconstruction of 54 cultural centers, covering 176,716 $m^2$; 52 libraries, covering 169,617 $m^2$; 27 theatres, covering 118,250 $m^2$; 22 opera troupes, covering 39,870 $m^2$; and 1,177 cultural stations, covering 386,110 $m^2$, which

were being reconstructed as part of the work on towns' broadcasting stations.

(5) Cultural relic preservation. The reconstruction designed to preserve cultural relics was mainly reconstruction of museums and cultural relic administration centers. It involved consolidating, repairing, and reinstalling antiseismic devices for 190 immovable cultural relics. It also involved the preservation of 23 cultural heritage sites (stockade villages) of the Qiang ethnic minority.

(6) The press and publishing. Reconstruction of the press and publishing focused on the rebuilding of publishing houses and Xinhua Bookstore. It mainly involved reconstructing 4 nonprofit publishing houses, 1,146 Xinhua Bookstore shops, 979 rural bookstores, and 2,835 public bulletin boards.

(7) Film and broadcasting. Reconstruction of film and broadcasting focused on rebuilding radio and TV stations, repairing machine rooms covering 222,800 $m^2$, and purchasing 20,100 pieces of equipment for interviewing, editing, producing, and broadcasting.

(8) Sports. Reconstruction of sports facilities included rebuilding and repairing two stadiums with areas of 354,000 $m^2$ and 206,540 $m^2$ respectively, and rebuilding and repairing two other sports venues with areas of 32,000 $m^2$ and 61,843 $m^2$ respectively.

(9) Social welfare. Reconstruction of social welfare facilities involved rebuilding, repairing, or expanding 2 polytechnic schools for orphans, 74 social welfare institutes (including children's welfare institutes and mental hospitals), 944 nursing homes, 45 "salvation stations" (including protection centers for homeless juveniles), 1,043 facilities for neighborhood committees, and 613 facilities for seniors such as senior citizen centers.

(10) Employment and social security. Reconstruction of employment and social security facilities involved setting up a comprehensive service center for employment and social security in every county (district) and a labor and social security station in each of the 543 newly rebuilt communities, covering 35,000 $m^2$.

(11) Local government. Reconstruction of facilities for local government involved reconstructing office buildings, whose total area is 13,788,000 $m^2$, and purchasing and maintaining 397,000 sets of office equipment.

**Infrastructure Reconstruction**

Infrastructure reconstruction focused on the following four areas:

(1) Transportation. The reconstruction of transportation systems focused on highways, railways, and aviation. Six national roads and 22 provincial roads (including 2 county roads under provincial finance) were newly reconstructed; 11 freeways were repaired and restored, and another 4 freeways were in the process of construction. The newly restored and reconstructed freeways and arterial highways total 1,599 km and 6,081 km, respectively. Affected arterial railways and branch railways were repaired and consolidated; seriously damaged railway stations and track sections (like the 109 tunnel on the Baoji–Chengdu Railway) were reconstructed. Aviation reconstruction work mainly focused on the repair and maintenance of various buildings and the restoration and replacement of ancillary airport facilities in the affected areas.

(2) Telecommunications. Reconstruction of telecommunications generally focused on communication facilities and post

offices. One hundred and thirteen fixed-communication switchboards and 56 broadband access units were reconstructed, and 1,036 mobile communication core nets and 7,809 base stations were reestablished. Damaged telephone circuits were repaired, and 2,783 villages originally with no telephone service were equipped with new phones. Fifty-seven comprehensive postal production facilities and 385 branch post offices were repaired and reconstructed; and 2,178 sets of postal production equipment and 3,826 vehicles were purchased and reinstalled.

(3) Energy. The reconstruction of energy infrastructure concentrated on power grids, power stations, coal mines, and oil and gas facilities. Three hundred and twenty-four transformer substations were repaired and rebuilt; 38 power supply substations and power distribution substations were reconstructed; and the power supply now reaches nearly 4.5 million households at centralized resettlement sites. Damaged power generation facilities were also repaired and restored, including 129 big and medium-size hydropower stations (with installed capacity of over 7 million kW). One hundred and sixty-four coal mines and their external infrastructure were repaired and restored. Reconstruction work in gas and oil took place for 1,176 gas wells, more than 100 natural gas pipelines, 8 oil depots, and 922 gasoline stations. The Zhongbai Purification Plant, Nanchong Oil Refinery, and Lanchengyu Oil Pipeline were all sites of reconstruction.

(4) Hydraulic engineering. Reconstruction of hydraulic engineering infrastructure mainly focused on hydropower stations and irrigation areas. For flood prevention and mitigation, 1,263 damaged reservoirs were repaired and consolidated, 105 quake lakes were cleared, dams totaling 890 km were reconstructed and consolidated, new dams totaling 309 km were built, and 112 hydrologic stations were restored. This work was part of the overall disaster prevention and mitigation system. For irrigation and water conservancy, the canals and related infrastructure such as canal headworks, pump stations, and aqueducts were repaired and reconstructed at seven large irrigation areas; damaged irrigation and drainage facilities were restored and repaired at 1,289 small and medium-size irrigation areas; and 55,498 independent mini-irrigation works were reconstructed. For water resource monitoring, the focus was on monitoring water quality, water sources, and ecological flow in the affected area. Ecological conditions were gradually restored to what they were before the earthquake, and 4,454 monitoring facilities are now in place at the control sections of major rivers.

**Mid-term adjustment of the plan**

Plans for some projects were necessarily adjusted during the implementation process to account for actual conditions. For instance, in Sichuan Province, the 18,496 projects originally planned for reconstruction of public service facilities, which were expected to require an investment of ¥97.41 billion, were cut to 15,051 and the required investment cut to 96.07 billion. The original 1,557 infrastructure reconstruction projects, expected to require an investment of ¥188.46 billion, were cut to 1,375 and required investment adjusted to ¥269.36 billion.

## Achievements of Public Facility and Infrastructure Reconstruction

Tax policy, monetary policy, employment assistance policy, and social insurance policy all played a role in the financing of public facility and infrastructure reconstruction. Funding came from financial allocations from the state government and provincial governments, from donor provinces by means of the twin assistance mechanism, from BOT arrangements, and from charitable contributions, which together made possible the achievements of the reconstruction work.

**Public facility and infrastructure reconstruction progress in Sichuan**

By September 2011, 16,419 reconstruction projects had been launched for public facilities and infrastructure in Sichuan. This represents 100 percent of the planned reconstruction tasks. Y 232.907 billion had been used for construction, or 97.97 percent of total postadjustment investment. The 15,050 public facility reconstruction projects, 100 percent of those planned, consumed Y 95.760 billion, representing 99.41 percent of the planned investment. In addition, 1,369 infrastructure reconstruction projects, 100 percent of those planned, used Y 189.923 billion, representing 97.57 percent of the planned investment (see table 5.2).

**Table 5.2 Public Facility and Infrastructure Reconstruction Progress in Sichuan (as of end-September 2011)**

| Type | Project contents | Projects planned | | Projects started | | Projects completed | |
|---|---|---|---|---|---|---|---|
| | | Total number | Investment (hundred million yuan) | Number | As share of planned projects (%) | Investment used (hundred million yuan) | As share of total investment (%) |
| Total | | 16,419 | 2,377.40 | 16,419 | 100 | 2,329.07 | 97.97 |
| Public facility reconstruction | Total | 15,050 | 963.25 | 15,050 | 100 | 957.60 | 99.41 |
| | Education | 3,001 | 430.91 | 3,001 | 100 | 429.84 | 99.76 |
| | Medical care | 2,032 | 137.33 | 2,032 | 100 | 137.29 | 99.96 |
| | Culture & sports | 4,081 | 95.77 | 4,081 | 100 | 81.05 | 84.63 |
| | Cultural heritage (relics) | 579 | 52.67 | 579 | 100 | 42.75 | 81.16 |
| | Employment & social security | 4,536 | 80.32 | 4,536 | 100 | 80.09 | 99.71 |
| | Social administration | 821 | 166.29 | 821 | 100 | 165.46 | 99.50 |
| Infrastructure reconstruction | Total | 1,369 | 1946.44 | 1,369 | 100 | 1,899.23 | 97.57 |
| | Transportation | 212 | 1219.75 | 212 | 100 | 1,186.58 | 97.28 |
| | Telecommunications & postal service | 6 | 168.29 | 6 | 100 | 168.29 | 100.00 |
| | Energy resources | 1,067 | 351.93 | 1,067 | 100 | 341.12 | 96.93 |
| | Water conservancy | 1,374 | 206.57 | 1,374 | 100 | 203.24 | 98.39 |

Source: Finance Department of Sichuan Province.

**Public facility and infrastructure reconstruction progress in Gansu and Shaanxi**

In, Shaanxi Province, public facility and infrastructure reconstruction work proceeded swiftly and smoothly, with the planned tasks essentially completed. By the end of 2010, for example, Ningqiang County in Shaanxi Province had started reconstruction work on all 477 planned public service projects and had finished work on 472, or 99 percent. Y 1.242 billion had been put into use, representing 108 percent of the total planned investment of Y 1.149 billion. Meanwhile, 30 infrastructure reconstruction projects were started and 28 projects, or 93.3 percent, were completed. Y 0.576 billion was spent, representing 94.4 percent of the total Y 0.61 billion planned investment.

In Gansu Province, public service facility and infrastructure reconstruction work began shortly after the earthquake, in compliance with the planning by the central government. All the planned tasks are nearly complete. By the end of July 2011, for example, Chengxian County had started all 138 reconstruction projects and completed 132, or 95.6 percent. Y 461,371,500 had been spent on the work, accounting for 98.1 percent of the planned investment.

## Public Facility and Infrastructure Reconstruction: Case Studies

### School reconstruction in urban areas of Dujiangyan

Before the earthquake, urban schools in Dujiangyan were not well placed relative to various urban facilities. Postquake reconstruction provided the opportunity to relocate the schools and extend the covered area. Some schools are now sited between the first and the second ring road, where the population is dense, and some new schools have been built outside the second ring road. These locations have improved the equilibrium distribution of urban schools and will be good for the future development of the city. The newly reconstructed schools have already been able to accommodate over 300,000 children of permanent residents and migrant workers, and that number is expected to grow to around 411,000 in the long run.

### Reconstruction of People's Hospital of Pengzhou

The new People's Hospital of Pengzhou that came out of the reconstruction is better than the old not only in terms of medical equipment, but also in terms of its management and the medical technologies it offers, which it was taught to use by its donor province. These improvements allow the hospital to better serve the residents of the city (see table 5.3).

**Table 5.3 Pengzhou People's Hospital before and after Reconstruction**

| | Before reconstruction | After reconstruction |
|---|---|---|
| Floor area | 37,000 $m^2$ | 84,042 $m^2$ |
| Building area | 51,000 $m^2$ | 48,000 $m^2$ |
| Beds available | 303 | 680 |
| Departments | 12 level-1 departments, 17 level-2 professional departments | Various professional departments and emergency department; 6 departments of internal medicine (cardiology, neurology, respiratory, gastroenterology, nephrology, oncology); 5 surgical departments (neurosurgery, urology, general surgery, orthopedic, thoracic); individual VIP section, ENT department, hemodialysis room, ICU |
| Major medical equipment | Japanese Lightspeed VCT, automatic biochemical instrument, CLIA instrument, ESWL equipment, and pathological graphics system | Standard operating room, nuclear magnetic resonance system, 64-layered Lightspeed VCT, DSIM, DSA, color Doppler ultrasound, endoscope, and other advanced medical equipment |

Source: Pengzhou Finance Bureau.

Note: VCT = video contrast tracker; CLIA = chemiluminescence immunoassay; ESWL = extracorporeal shock wave lithotripsy; DSIM = data set information map; DSA = digital subtraction angiography.

# 6

# Evaluation of Infrastructure Restoration and Reconstruction Progress in Rural Areas

## Loss of Infrastructure in Rural Areas

Before the earthquake, Sichuan, Gansu, and Shaanxi enjoyed stable and fast-growing economies. The foundation of the provinces' rural economies, however, was comparatively weak. The earthquake caused a significant loss to the rural infrastructure; a large number of villages were almost leveled, public service capability and productivity were weakened, and – more importantly – a large proportion of the affected population lost homesteads, farms, and production materials, which intensified poverty in the affected areas (see table 6. 1).

**Table 6. 1 Loss of Rural Infrastructure Caused by Wenchuan Earthquake**

| Infrastructure | Sichuan | Gansu | Shaanxi | Total |
|---|---|---|---|---|
| Roads (tens of thousands of kilometers) | 1. 95 | 0. 04 | 0. 21 | 2. 20 |
| Bridges (tens of thousands of kilometers) | 6. 56 | 0. 25 | 0. 01 | 6. 82 |
| Drainage pipes (tens of thousands of kilometers) | 1. 20 | — | 0. 07 | 1. 27 |
| Trash recycling stations (number) | 2, 501 | — | 1, 256 | 3, 757 |

Source: Planning of Postearthquake Rural Reconstruction (State Council, October 2008).
Note: — = not available.

## Goals of Rural Infrastructure Restoration and Reconstruction

In September 2009, the state conducted a mid-term evaluation of reconstruction progress and made some adjustments to initial plans: the number of reconstruction projects in rural areas was reduced to 1, 850, and the budgetary investment reduced to Y 57. 5 billion. In Sichuan Province, the number of rural reconstruction projects dropped from 191 to 184, and the budgetary investment of Y 70. 1 billion fell to Y 53. 6 billion. Specifically, the living and productive facility reconstruction projects were reduced in number from 152 to 145, and the planned investment reduced from Y 61. 1 billion to Y 46. 5 billion; the number of work-relief projects remained unchanged, but the investment was cut from Y 9. 0 billion to Y 7. 1 billion (see table 6. 2).

**Table 6.2 Rural Reconstruction Projects before and after Mid-Term Adjustment**

| | Before adjustment | | After adjustment | | | |
|---|---|---|---|---|---|---|
| | Number of projects | Budgetary investment (billion yuan) | Number of projects | Budgetary investment (ten thousand yuan) | Difference between pre – and postadjustment investment (ten thousand yuan) | Change in investment (%) |
| Total rural reconstruction | 191 | 70.1 | 184 | 5,359,583 | 1,651,436 | –23.6 |
| Rural life and production facility projects | 152 | 61.1 | 145 | 4,651,573 | 1,458,540 | –23.9 |
| Work-relief projects | 39 | 9.0 | 39 | 708,010 | 192,896 | –21.4 |

Source: Midterm evaluation report on postearthquake reconstruction, China International Engineering Consulting Corporation, June 2010.

## Achievements of Rural Infrastructure Reconstruction

### One year into reconstruction

After one year of implementing the Overall Plan, half of the construction projects had been started and half the investment used. A solid foundation was in place for the Overall Plan's stated goals of a home for each household, a job for each person, improved infrastructure, a developed economy, and a better natural environment.

### Two years into reconstruction

The mid-term adjustment (made after two years) ensured the reconstruction work was carried out under rational and scientific principles. Each province determined completion deadlines of the major tasks after the adjustment and struck a good balance between the progress required by the Overall Plan and the need for safety in carrying out the reconstruction work. Following the idea of generally condensing the reconstruction scale, the affected areas began to reduce the number of their reconstruction projects, and shifted their focus onto the restoration and reconstruction of urban and rural housing, public facilities, and urban systems. Among all the affected areas, Wenchuan, Beichuan, and Qingchuan were most seriously damaged in the earthquake; the reconstruction work there was extremely difficult and expensive, and the central government provided appropriate financial support.

In Sichuan Province, reconstruction was underway for all projects involving agricultural production facilities, rural infrastructure, agricultural industry, and work relief, at a cost of ¥53.486 billion, or 99.79 percent of total planned investment. Except for a few projects that were delayed, all projects were close to completion, as planned. Figure 6.1 shows roadways completed after two years of reconstruction.

### Three years into reconstruction

After three years, all the reconstruction tasks were almost completed as planned. Of all 1,850 projects started, 1,842 were finished, at a total cost of ¥57.513 billion. The agricultural production facilities and infrastructure reached or even exceeded their prequake levels. Local governments of the

**Figure 6.1 Reconstructed Roads in Ngawa Tibetan and Qiang Autonomous Prefecture, February 2010**

Source: Authors.

affected areas not only successfully carried out the postquake reconstruction, but also kept sustainable development in mind. For instance, Guangyuan formulated the Postquake Development and Revitalization Plan, which effectively links postquake reconstruction and future sustainable development.

Rural infrastructure reconstruction not only solved the resettlement problem of the affected population but also paved the way for future development. Because reconstruction was completed ahead of schedule, the affected population was resettled in a timely fashion; and the prompt restoration and reconstruction of infrastructure and production facilities has improved living conditions and promises better economic development. Consider the following:

First, macroeconomic growth is the fundamental driving force for overall development and poverty relief in the quake-affected areas. The reconstruction efforts have improved rural infrastructure over prequake levels; this improvement, coupled with preferential financial policies, credit policies, and industrial policies in the area, will increase demand for consumer goods and production materials and consequently drive growth in the local economies.

Second, reconstruction has provided local peasants with new market opportunities. The fast growth of special industries (such as tourism) in the affected areas and the implementation of reconstruction projects have increased employment. They have also driven the development of various labor-intensive industries like construction, transportation, and catering, which substantially benefits local peasants. The development of the livestock-breeding industry, fruit-growing, and forestry has helped local peasants recover production capability, and entrepreneurial agricultural park projects are beginning to play an increasingly important role. It should be mentioned that the poor population is less capable of seizing opportunities of this kind than are the nonpoor.

Third, social development is good for rural economic development in the long run. The reconstruction work has improved public service facilities at schools and hospitals so they are significantly better than their prequake levels; the social security system is improving, and public services are more widely available at a much lower cost. The restoration of rural infrastructure, such as water-treatment facilities and roads, has improved the living conditions of the peasants and more importantly promoted economic development in rural areas.

Fourth, the reconstruction projects in poor villages have served to reduce poverty. These projects have directly improved production capability and living conditions in poor villages, promoted peasants' construction capability, and increased agricultural incomes. Under the financial support of the Special Fund for Poverty Alleviation and microcredit funds, poor peasant households have generally recovered their production capability. In the coming 5 to 10 years, special funds for poverty alleviation will still be available to help peasants in the seriously affected areas get out of poverty and achieve better development.

**Experiences of rural reconstruction**

Four experiences were especially significant in rural reconstruction.

First, nature should be respected. Site selection for housing reconstruction depended on the specific geological situation, which influenced decisions about on-site reconstruction, nearby reconstruction, and resettlement.

Second, peasants have a principal role. The reconstruction work should respect their preferences and legal interests and lead them to rebuild their communities.

Third, urban-rural integration should be strengthened. Rural reconstruction was undertaken in conjunction with urbanization to promote rapid growth of the agricultural industry, improvement in rural living conditions, and increases in employment and income that will narrow the urban-rural gap in both these areas.

Fourth, poverty-alleviation efforts should be strengthened. Special funds from the postquake restoration and reconstruction funds supported the reconstruction of poor villages. Other poverty-alleviation efforts included employment training for rural surplus laborers, developing local industry, migrant support, and social assistance.

**Problems faced in rural reconstruction**

Rural reconstruction efforts faced two main problems. First, the earthquake seriously damaged rural housing and pushed residents further into poverty. Housing damage was the most destructive consequence of the earthquake in rural areas, representing over 90 percent of the peasants' economic loss and pushing some peasants back into poverty. The subsequent housing reconstruction also added to their debt burden.

Second, rural reconstruction faced the challenge of frequent geological disasters. The earthquake imposed serious geological damage, splitting mountains, loosening slopes, piling up debris, rechanneling canals, and causing soil liquefaction, all of which complicated the reconstruction work and future development of the affected areas. The serious damage to the geological environment and the frequent aftershocks put the affected areas at risk of further geological disasters in the coming decades, making it crucial to establish detailed emergency strategies for potential geological disasters.

## Pre- and Postquake Comparison: Case Studies

**Shangping Village in Lveyang County, Shaanxi Province**

Shangping Village in Xujiaping was located 20 km west of Lveyang County. There were 152 residents living in 35 households in

Shangping. The Wenchuan Earthquake toppled 77 rooms occupied by 22 households, seriously damaged 24 rooms occupied by 7 households, and generally damaged 29 rooms occupied by 6 households; 31 of the households needed their housing to be reconstructed. Later, Shangping was found to be a geological hazard because of landslides, and the affected 31 households had to be resettled, a step requiring a large capital investment. Tianjing and Shaanxi signed the Framework Agreement on Tianjing-Shaanxi Twin Assistance for Postquake Restoration and Reconstruction, which provided support for the reconstruction of 121 projects under nine categories, for a total of ¥ 0.88 billion. It was reported that the resettlement cost each household ¥ 110,000, of which they themselves should afford ¥ 45,000; because local credit cooperatives made loans of at least ¥ 30,000, the remaining ¥ 15,000 was generally affordable for them. The newly rebuilt houses are of two stories and have three bedrooms, a living room, a bathroom, and a kitchen linked to sewage gas. (Houses are shown in figure 6.2). The local residents are now making a living selling Chinese herbal medicines, live pigs, black chickens, and walnuts.

**Figure 6.2 Shangping Village after Reconstruction, February 2010**

Source: Authors.

**Laojie Village in Yingxiu, Sichuan Province**

Laojie Village was located north of Yingxiu Town, about 56 km from Wenchuan County, and five subvillages (Laojie, Douyaping, Baijialin, Xiguanao, and Ganxipu) populated with 140 households totaling 418 residents were under its administration. It was known for its rich production of crops such as corn, rape, and Chinese gooseberries.

The Wenchuan Earthquake toppled or seriously damaged most of the total 598 houses; destroyed infrastructure such as roads, water, and electricity supply; and destroyed farmland covering 156 acres, of which 70 acres were lost entirely. Thus land became the foremost complication in the reconstruction of Laojie. Resettlement took place on site and nearby. The reconstruction adopted the welfare-to-work approach and was financed with postquake reconstruction funds, the twin assistance mechanism, and agricultural project funds. By the end of September 2009, 138 houses had been reconstructed, 2 houses had been repaired, and residents had moved in. During reconstruction, Laojie improved its infrastructure facilities, rebuilt its villagers' committee and villager activity center, finished construction of concrete and pavement roads, built a new water-supply and drainage system, built parking lots, and planted trees on 85 percent of the village area. Laojie also took the opportunity of seeking to establish itself as a 5A scenic spot to highlight its characteristic architecture, which is typical of the Zang and Qiang ethnic minorities. Thanks to funding from Dongguan in Guangdong Province under the the twin assistance mechanism, it has already been identified as a model village showing postquake reconstruction and an important tourism site (see figure 6. 3).

**Figure 6. 3 Reconstructed Residences and Village Activity Center of Laojie Village, Sichuan Province, February 2010**

Source: Authors.

### Xuanmawan Village in Kangxian County, Gansu Province

Xuanmawan Village in Nianba was located in western Kangxian County and was home to 295 households made up of 1, 260 residents in total. The village suffered severe losses in the Wenchuan Earthquake; 255 households needed their housing reconstructed, and the remaining 40 households needed their housing repaired. The rebuilt houses were sited very close to their original locations, following the standard disaster prevention and mitigation guidelines. After the reconstruction, the village was considerably modernized: clean, wide roads run through the village, solar streetlights flank the roads, and mosquito-killing lamps are set up on the square. The neatly arrayed two-story houses not only serve as shelter but also potentially offer space for businesses. A square was built in the middle of the village to complement its beautiful natural environment and towering trees, and pavilions were installed with recreation facilities for tourists. Tourism in the village was growing fast, and in response some residents turned one story of their houses into home inns; growth in tourism has created employment for local surplus labor and has increased residents' income (see figure 6. 4).

**Figure 6.4　The Reconstructed Xuanmawan Village in Gansu Province, August 2011**

Source: Authors.

# 7

# Evaluation of the Industrial Restoration and Reconstruction Process

## Losses Caused by the Earthquake

The Wenchuan Earthquake caused great damage to agricultural production in 39 counties, cities, and districts in Sichuan Province. Crops covering an area of 4.89 million mu were damaged by the earthquake, cultivated fields measuring 1.68 million mu were destroyed, and 2.0235 million mu of grain crops, as well as nearly 2.0385 mu in economic crops, were harmed. The earthquake also caused damage to agricultural production in 12 other counties or districts of Gansu Province and Shannxi Province. Table 7.1 shows how the earthquake affected gross regional product in some of the worst-hit counties.

**Table 7.1 Agricultural Losses in Affected Areas in Sichuan, Gansu, and Shaanxi**

| Province | Crop cultivation | | Livestock | | Fishery | |
|---|---|---|---|---|---|---|
| | Food crops (10,000 mu) | Cash crops (10,000 mu) | Livestock and poultry area (10,000 $m^2$) | Livestock and poultry (10,000 head) | Fishpond area (10,000 hectares) | Output (10,000 tons) |
| Sichuan | 202.35 | 203.85 | 2,759.8 | 3,193.0 | 0.67 | 2.7500 |
| Gansu | 36.45 | 29.25 | 146.9 | 2.4 | 0.01 | 0.0032 |
| Shaanxi | 2.4 | 4.65 | 56.2 | 8.4 | 0.02 | 0.1000 |
| Total | 241.2 | 237.75 | 2,962.9 | 3,203.8 | 0.69 | 2.8500 |

Source: Planning on Restoring and Reconstructing the Distribution of Productive Forces and Industrial Restructuring for Wenchuan Earthquake (State Council, October 2008).

In the areas heavily affected by the earthquake there were 12,940 industrial enterprises, including 10,849 in Sichuan Province, 759 in Gansu Province, and 882 in Shannxi Province. The area occupied by damaged plants covered 50.93 million $m^2$; some 370,000 facilities were damaged. Mainstay industries, such as tourism and planting in the disaster area, suffered severe losses.

As to tertiary industry, 361 scenic spots in Sichuan were affected; Jiuzhaigou, Huanglong, Sigunianshan, Yinchanggou, Wolong, Dujiangyan, and some other important tourism sites were badly damaged. Tourist farms also suffered from heavy losses. Cultural enterprises and industry were also badly damaged in 39 counties, cities, or districts in Sichuan Province. There was damage to 190 cultural relics, and 44 percent of what had been designated "intangible" cultural heritage was seriously damaged. Finally, 145, 445 commercial service outlets and 3, 410 financial outlets were subject to different degrees of damage.

## Developmental Planning: Goals of Agricultural and Industrial Restoration and Reconstruction

**Goals of agricultural restoration and reconstruction**

The goal of agricultural restoration was to optimize the agricultural production structure and effect a more rational arrangement over three years, based on recovery of overall productive capacity. The idea was for agriculture, animal husbandry, and fishery to develop gradually and in conjunction with one another, and for farmers' income to grow accordingly. Reconstruction work mainly involved the reconstruction of the agricultural production base and the restoration of agricultural production facilities.

**Goals of industrial restoration and reconstruction**

The main goals of industrial reconstruction were to implement national industrial policies, give priority to restoration and employment projects in disaster-affected areas, speed up the restoration of key industries, promote high-tech industries, eliminate backward production capacity, guide industry clusters, develop the so-called recycling economy, and enhance the competitiveness of regional industry. Taking the county economy as the driver, and based on the clear position of each region's industry, the basic principle was to allow leading enterprises' to drive the growth and development of industries with local resource advantages and to achieve appropriately concentrated industrial development. The types of industrial restoration and reconstruction are summarized in table 7. 2.

**Table 7. 2** **Industrial Restoration and Reconstruction Projects in Affected Areas in Sichuan, Gansu, and Shaanxi**

| Project type | Total | Sichuan | Gansu | Shaanxi |
|---|---|---|---|---|
| Restoration of the original enterprise | 2, 261 | 2, 057 | 152 | 52 |
| Reconstruction of the original enterprise | 729 | 564 | 99 | 66 |
| Construction of a new enterprise | 611 | 459 | 103 | 49 |
| Total | 3, 601 | 3, 080 | 354 | 167 |

Source: Planning on Restoring and Reconstructing the Distribution of Productive Forces and Industrial Restructuring for Wenchuan Earthquake (State Council, October 2008).

**Goals of tertiary industry restoration and reconstruction**

Different goals existed for different industries.

For tourism, there was a threefold goal of "restoration, optimization, and extension" – that is, tourism's productive capacity should be restored, its structure optimized, and it range extended. Earthquake-site tourism should be developed.

For the cultural industry, the major goals of restoration and reconstruction were to develop the industry, improve the public cultural service system, build a distinguished cultural industry belt and cultural industry clusters, and achieve balanced development between urban and rural public cultural service.

For the market service system, the major goal of restoration and reconstruction was to rebuild the commodity retail network, living services network, wholesale trade system, logistics and distribution system, livestock slaughter and processing system, grain circulation system, financial service system, and so forth in order to restore life to normal in the shortest possible time and pave the way for later normal production.

**Mid-course adjustment of the plan**

Some departments of the Chinese government made partial adjustments to the restoration plan in accordance with issues encountered during the restoration and reconstruction process. Details of the adjustments made in Sichuan are given in table 7. 3.

**Table 7. 3 Restoration Plan in Sichuan before and after Mid-Term Adjustment**

| | Before adjustment | | After adjustment | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Number of projects | Estimated investment (billion yuan) | Number of projects | Change in number of project | Percent change | Planned investment (billion yuan) | Change in investment (million yuan) | Percent change |
| Distribution | 10, 704 | 150. 8 | 11, 236 | 532 | 5. 0 | 159. 6 | 8, 727. 4 | 5. 8 |
| Industry | 1, 538 | 113. 8 | 3, 133 | 1, 595 | 103. 7 | 126. 5 | 12, 666. 9 | 11. 1 |
| Tourism | 173 | 4. 9 | 187 | 14 | 8. 1 | 7. 6 | 2, 639. 4 | 53. 4 |
| Culture | 2, 338 | 2. 9 | 1637 | −701 | −30. 0 | 2. 2 | −713. 7 | −24. 8 |
| Business service and food distribution | 6, 615 | 21. 7 | 6, 239 | −376 | −5. 7 | 17. 1 | −4, 570. 3 | −21. 1 |
| Financial service | 39 | 4. 5 | 39 | 0 | 0 | 3. 3 | −1, 294. 9 | −28. 5 |
| Innovative financing | 1 | 3. 0 | 1 | 0 | 0 | 3. 0 | 0 | 0 |

Source: Finance Department of Sichuan Province.

## Positive Effects of Restoration and Reconstruction on Industry in Affected Areas

In order to ensure that industrial restoration and reconstruction proceeded smoothly, the central and local governments used finance policy, taxation policy, economic policy, industrial policy, land policy, and employment policy. Central and local financial investment was coordinated; bank loans and other funds enhanced the effects of policy instruments to guarantee the industrial restoration and reconstruction process.

**Progress in industrial reconstruction**

By September 2011, 4, 989 industrial reconstruction projects had been started in Sichuan, representing 100 percent of the restoration and reconstruction tasks. They included 3, 130 industrial projects, 186 tourism projects, 1, 634 were cultural projects, and 39 financial service projects. There were 4, 957 restoration projects that were finished, representing 99. 35 percent of the planned projects. The total cost for the projects completed reached Y 135.996 billion, or 99.97 percent of the planned investment. There were 6,239 business service and food distribution facility projects that were started, representing 99.66 percent of the restoration task. The total cost was Y 23.139 billion, or 99.13 percent of the planned investment.

**Economic recovery**

After one year of postearthquake restoration, the gross regional product of 11 Sichuan counties heavily affected by the earthquake had roughly returned to their levels before the earthquake. Gross regional product in the other 9 worst-affected counties – excepting Mianzhu County and Beichuan County – had surpassed 2007 levels. Because Dongfang Electric Co. moved out of Mianzhu County, and Beichuan County had to be reconstructed off site, the gross regional product of these counties did not rebound as well as that of other counties. See figure 7.1 for details.

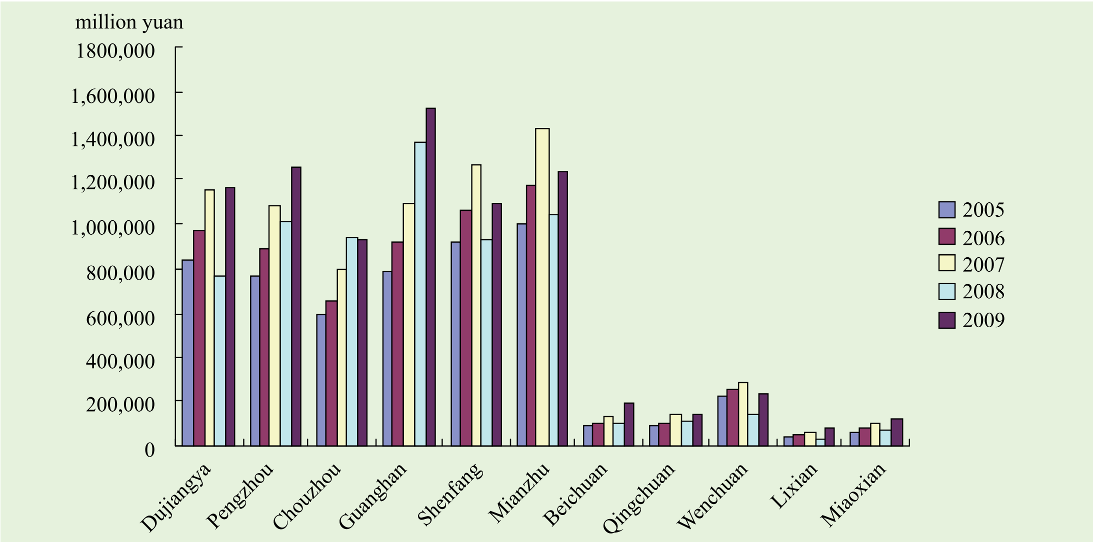


**Figure 7.1 Gross Regional Product of the Heavily Affected Sichuan Counties before and after the Earthquake**

Source: Sichuan Statistical Yearbook (Statistical Bureau of Sichuan, 2006–2010).

By September 30, 2010, 184 restoration and reconstruction projects had been started; the projects involved agricultural production facilities (restoration of cultivated land, crop production, animal husbandry, and agricultural machinery), agricultural basic infrastructure (water supply projects in rural areas, methane and sanitary projects), the agricultural base (crop, animal husbandry, and aquatic products), other agricultural construction projects, work relief, and the reconstruction of poor villages. The cost was Y 53.486 billion, or 99.79 percent of the planned investment. See figure 7.2 for details of 11 heavily affected Sichuan counties.

By October 2010, economic development in the disaster-affected area of Sichuan had recovered to pre-earthquake levels. Of 2,440 industrial enterprises covered under national overall planning, 98.3 percent had been restored; a few were simply not rebuilt, and a few were weeded out because of high emission levels or serious pollution. Of 10,704 projects involving adjustment of industrial structure, 98.2 percent had been accomplished. Because of industrial reconstruction, the industrial restructuring process was accelerated and industrial layout was

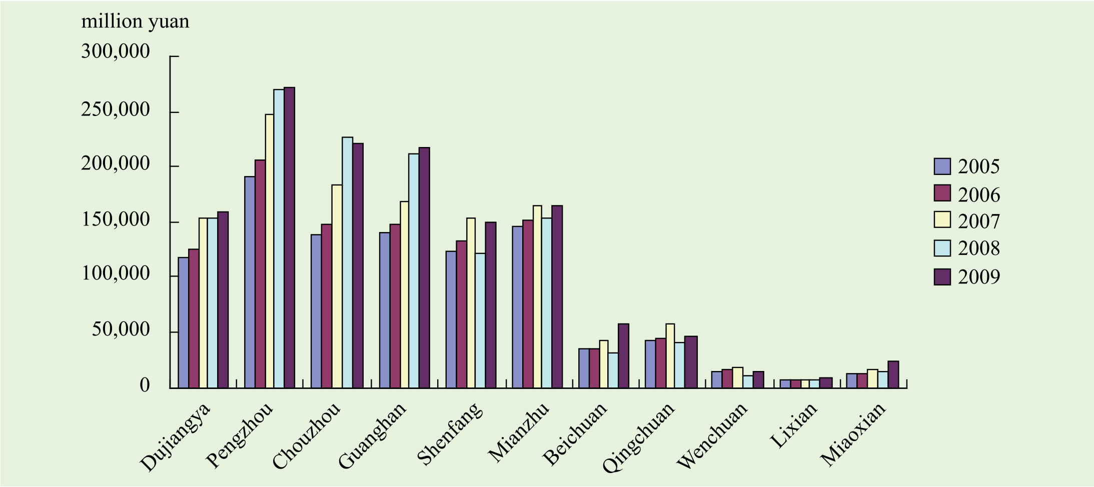


**Figure 7. 2 Primary Industry Output in the Heavily Affected Sichuan Counties before and after the Earthquake**

Source: Sichuan Statistical Yearbook (Statistical Bureau of Sichuan Statistics, 2006 – 2010).

gradually optimized. Of the 11 counties most heavily affected by the earthquake, 6 counties recorded an industrial output in 2009 that surpassed that of 2007; five counties – Dujiangyan, Shenfang, Mianzhu, Qingchuan, and Wenchuan – did not. See figure 7. 3 for details of 11 heavily affected Sichuan counties.

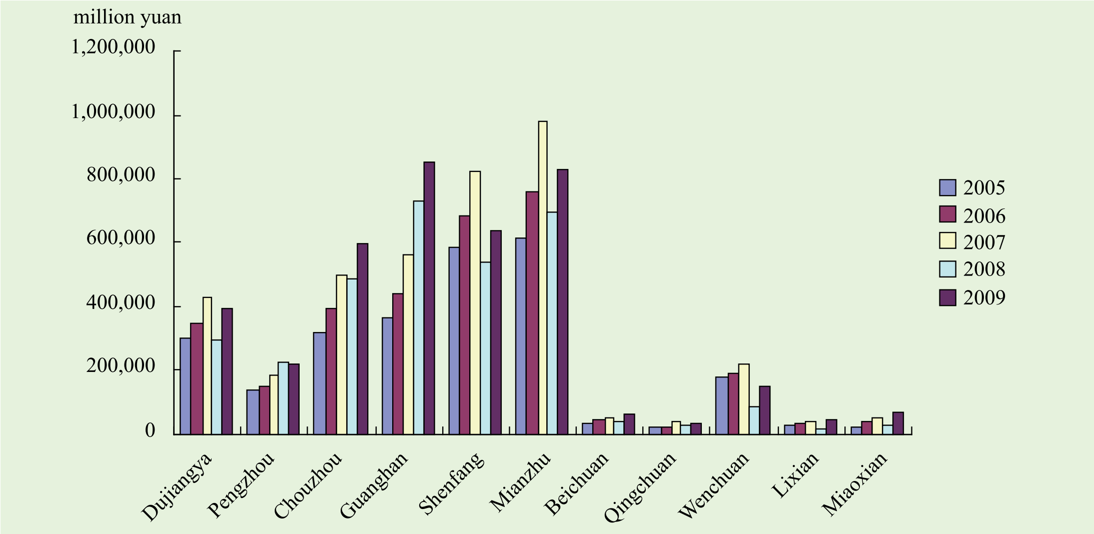


**Figure 7. 3 Secondary Industry Output in the Heavily Affected Sichuan Counties before and after the Earthquake**

Source: Sichuan Statistical Yearbook (Statistical Bureau of Sichuan, 2006 – 2010).

Since tertiary industry relies less than others on specific infrastructure, the restoration of this industry went relatively quickly. In 2009, the tertiary industry output of the 11 heavily affected counties had surpassed 2007 levels. By the end of 2010, of 175 tourism planning and restoration projects in 39 heavily affected counties of Sichuan Province, 151 had been started, representing 86.3 percent of projects. Seventy-five projects had been completed, representing 42.8 percent of the planned projects. The investment fulfilled was Y 47.86 billion, or 63.1 percent of the planned investment. As early as 2009, the tourism level in Sichuan had recovered and even exceeded the level before the earthquake. See figure 7.4 for details of 11 heavily affected Sichuan counties.

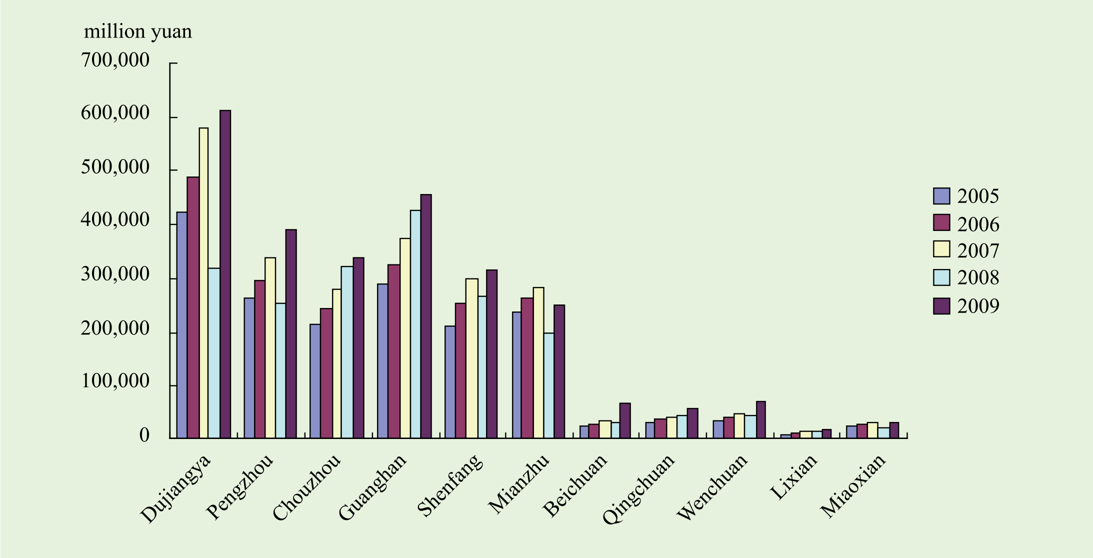


**Figure 7.4 Tertiary Industry Output in the Heavily Affected Sichuan Counties before and after the Earthquake**

Source: Sichuan Statistical Yearbook (Statistical Bureau of Sichuan, 2006 – 2010).

**Innovative model to achieve industrial upgrading**

The object of industrial restoration and reconstruction was not merely to restore the economy to its pre-earthquake level, but to optimize and upgrade industrial structure. Some industrial parks, including Feidi Industrial Park, Lianjian Industrial Park, and Economy Recycle Park, not only served as a vehicle for more general economic recovery but also brought about industrial upgrading in affected areas. Part of the workforce in affected industries was transferred to more advanced ones located in industrial parks or other safe places. For example, workers in the Shuimo cowhide processing plants (which emitted significant pollution) found jobs during reconstruction in the tourism industry. This was an instance of relatively smooth industrial upgrading.

## Some Other Effects of Industrial Restoration and Reconstruction

**Unity of energy conservation and industrial upgrading**

The five tons of construction waste produced by the earthquake provided an opportunity for a couple of demonstration projects in construction waste recycling. The projects adopted a variety of innovative Chinese methods, including fully sealed automatic equipment (for treating garbage), formation of composite material out of construction waste, light materials, engineering structure products, composite wall, and recyclable concrete and other building material. Using these methods, construction waste caused by the earthquake was largely reduced.

**Unity of cultural promotion and industrial development**

After the earthquake, in July 2008, prompted by an assistance plan developed by the Chinese Red Cross Jet Li One Foundation in Chengdu, the Aba Qiang employment assistance center for female embroidery workers came into being. By December 2009, 8,000 women from Wenchuan County, Li County, and Mao County had joined the center and found work as embroiders. By December 2009, they had embroidered 344,000 pieces, which eventually became part of fashionable handbags, luxurious clothing, and office supplies.

## Five Lessons of Industrial Restoration and Reconstruction

Five lessons can be derived from the experience of industrial restoration and reconstruction following the Wenchuan Earthquake.

**Lesson 1. China's political and economic systems can be used to advantage.**

Strong central leadership facilitated a successful multimode approach to financing and carrying out reconstruction. Direct financial support from the central government, support from counterpart provinces via the twin assistance mechanism, and the cooperation of the construction industry made possible a smooth, rapid, and successful restoration process.

**Lesson 2. A reconstruction model should accord with the national situation and disaster area characteristics.**

Reconstruction and restoration following the Wenchuan Earthquake embodied five sets of "combinations," as follows: the combination of self-construction with striving for external assistance; the combination of horizontal cooperation across the same level of governments with vertical cooperation between different levels of governments; the combination of restoration restricted by law and instructed by plan; the combination of leading by central government and fulfillment by local government; and the combination of industrial facility reconstruction and system innovation.

**Lesson 3. Reconstruction can strengthen self-development capacity in the industrial economy.**

Previous reconstruction efforts used a "blood transfusion" model – that is, they relied on outside assistance; but after the Wenchuan Earthquake, a "blood creation" model was also used – that is, self-development of affected areas was also expected. This new model facilitated industry's self-development in affected areas.

**Lesson 4. Reconstruction facilitates optimization of industrial layout and economic development.**

Reconstruction can optimize industrial layout and economic development by changing the layout of industrial parks in rebuilding or by speeding up the restoration process of damaged industrial parks in suitable reconstruction areas. In general, reconstruction planning can guide rational development of industrial clusters and optimization of industrial structure in disaster areas.

**Lesson 5. Innovative financing can support industrial reconstruction.**

Financial departments at all levels of government actively explored all kinds of innovative financial mechanisms and models to use in support of industrial restoration in disaster areas. They mobilized credit funds and social funds, enacted various preferential tax and finance policies, and used spare land made available through land renovation and funds from land transfer fees for industrial park construction.

# 8

# Evaluation of Reconstruction Progress in Off-Site Locations

## The Necessity of Off-Site Reconstruction

Located in the mountains, Beichuan and Qingchuan Counties lagged behind other counties in social and economic development and were among the poorest in the country. Hanwang Town in Mianzhu City was an important industrial area and had relatively good economic development. All three were heavily hit by the Wenchuan Earthquake, suffering many casualties, grave losses to property and industry, and severe damage to infrastructure. The severity of the damage made reconstruction in off-site locations a necessity.

**Beichuan's losses in the earthquake**

Located in the transitional zone from the upland to the highland area in the Sichuan Basin Beichuan County is the only Qiang ethnic minority autonomous county in China. Its terrain is 98. 8 percent mountainous. Before the earthquake, Qushan Town was the center of Beichuan County. The earthquake hit Qushan Town particularly hard, with the seismic intensity there reaching X (10) degrees. Eighty percent of the town's buildings collapsed, only 4, 000 of 10, 000 residents survived, and nearly 30 villages were buried by landslides and mud-rock flows. Roads, bridges, electricity, communications infrastructure, water supply infrastructure, and other fundamental facilities were entirely destroyed (see figure 8. 1).

**Qingchuan's losses in the earthquake**

Qingchuan County is located along the north edge of the Sichuan Basin, in the area downstream of Bailongjiang and where Sichuan, Gansu, and Shannxi Provinces meet. Qingchun County suffered extraordinarily heavy losses in the Wenchuan Earthquake, recording seismic intensity of over X (10) degrees. The earthquake lasted about 10 minutes, causing 4, 697 deaths and leaving 124 missing and 15, 479 injured. Qingchuang also suffered repeated aftershocks that caused landslides and mud-rock flows.

**Hanwang Town's losses in the earthquake**

Hanwang Town, subordinated to Deyang and Mianzhu City, is located in the middle to northern edge of the Sichuan Basin. Hanwang Town is an important industrial center and the location of the Dongfang Steam Turbine Works, one of the three largest steam turbines in China, and 17 other large-scale enterprises. The seismic intensity here reached X (10) degrees, causing 4, 000 deaths and injuring over 10, 000. Of 13, 360 houses in the town, 98 percent collapsed or were seriously damaged. Power supply,

**Figure 8.1 Serious Earthquake Damage in Beichuan County**

Source: http://news.jxgdw.com/jszt/512wcddzyzn/zxbd/1060062.html.

water supply, gas supply, oil supply, road transportation, communication facilities, and other infrastructure were all severely affected. Enterprises in Hanwang Town, including the Dongfang Steam Turbine Works, suffered heavy losses and stopped production (see figure 8.2).

**Figure 8.2 Earthquake Damage to Houses and Factories in Hanwang Town**

Source: http://news.jxgdw.com/jszt/512wcddzyzn/zxbd/1060062.html.

## Goals of Off-Site Restoration and Reconstruction

### Planning and construction goals of New Beichuan County

The new county is labeled as the political, economic, and cultural center of the western Sichuan tourism service base, the center of the western Mianyang industrial base, and the modern Qiang cultural center. The new county focuses on public service functions and is positioning itself as a regional tourist-reception center and resort area. The planned population size was to be 30,000 in 2010; by 2015 the population is expected to reach

50, 000 and by 2020 70, 000. New county construction was to cover an area of 3 $km^2$ in 2010; in 2015, the area would be 6 $km^2$ and in 2020 7 $km^2$. See figure 8. 3 for the location of the new county.


**Figure 8. 3 Map of New Beichuan County**

Source: Sichuan Postdisaster Reconstruction Office.

Note: The red circle in the middle is New Beichuan County. Arrows in several colors indicate roads and bridges to other counties or cities; these links will help to establish Beichuan as the western Sichuan tourism service base, the center of the western Mianyang industrial base, and the modern Qiang cultural center.

Construction in the new county consists mainly of multistory and low buildings; in the industrial plant area multistory buildings are particularly encouraged. Plot ratio and building density are controlled in accordance with the corresponding development. The city's appearance should not be neglected. The planning was organized and carried out entirely by the local Beichuan government. Necessary adjustments can be made to the plan as operations go forward.

**Planning and construction goals of new Zhuyuan Town in Qingchuan County**

Located in northern Qingchuan County, Zhuyuan Town is about 80 km from the old town, Qiaozhuang. According to the document called Planning of Qingchuan County and Town, Sichuan Province (2008 – 2020), Zhuyuan Town is a first-level center town in Qingchuan City. As the largest town in Qingchuan County, Zhuyuan Town serves as a subordinate area of Qingchuan City, and is being developed in coordination with Jianfeng Town and Malu Town to form a "Big Zhuyuan Town." Development is being carried out to better integrate industrial distribution, the layout of town functions and infrastructure, and environmental protection functions. "Big Zhuyuan Town" will be the future center of Qingchuan's economy as well as an educational and cultural center. By

2020, the town's population will be over 50, 000 and the constructed area about 5 km$^2$.

According to the planning document, the town will include "one river, two mountains and six districts" (see figure 8. 4).

**Figure 8. 4 Map of Zhuyuan Town, Qingchuan County**

Source: Overall Reconstruction Plan for Zhuyuan Town (2008 – 2020) (Sichuan Postdisaster Reconstruction Office, October 2008).

Note: The map shows the town's "one river" (blue line), "two mountains" (green area on either side of the river), and "six districts" (one in each bend of the river).

**Planning and construction goals of Hanwang Town**

Hanwang Town has been reconstructed as an important site for Wenchuan Earthquake relics and tourism in western Sichuan and as a business goods distribution center. According to the reconstruction plan, the population in 2010 was to be 23, 000; by 2020 it should be 30, 000.

Hanwang Town is composed of the old and new areas. The old town consists of an area that preserves earthquake relics and a reconstruction area; the new town consists of a construction area and long-term development area. It was proposed in one of the planning documents – Overall Planning of Hanwang Town, Mianzhu City (2008 – 2020) – that the core sector along the mountain pass in the old town be kept as an earthquake relic area covering 1 km$^2$ and that an earthquake relic museum be set up there within one or two years. The new construction area includes Dea Road and the area circled by Dea Road and Mianyuan River; it covers 2 km$^2$ and has a population of about 27, 000. The new area is intended as the political, cultural, and economic center of the whole town and has administrative control of the town as well as its public service functions. Facilities and infrastructure for administration, trade and finance, education, transportation, water supply, and gas supply are located in the new-construction area (see figure 8.5).


**Figure 8.5　Map of Hanwang Town**

Source: Overall Reconstruction Plan for Hanwang Town, Mianzhu City (2008 – 2020) (Sichuan Postdisaster Reconstruction Office, October 2008).

Note: The earthquake park (purple) is at the center of the old town; to the southeast is the reconstruction area in the original town (green), the off-site reconstruction area (yellow), and the industrial area (blue).

## Achievements of Off-Site Reconstruction

### Reconstruction accomplished on time

Through three years of hard work and by following scientific guidelines, planned construction tasks in New Beichuan County, the new Zhuyuan Town of Qingchuan County, and Hanwang Town of Mianzhu County have been roughly accomplished. The basic town functions and facilities are in use and people have moved to the new town to start their new life. By September 30, 2011, 298 projects in 10 categories, or 100 percent of those planned, had been started; of these, 293 projects, or 98.3 percent, have been completed. The capital investment for the projects came to Y 18.9 billion, or 97 percent of the investment planned.

### Urban housing improved

In the off-site construction process, residential reconstruction was always given the highest priority and people's housing problems were the first problems addressed. Eight indemnificatory housing construction projects were started in the three areas discussed above (Beichuan County, Zhuyuan Town, and Hanwang Town) with Y 3.58 billion invested. Under these projects, 21,529 indemnificatory houses were built and shelter provided for nearly 80,000 people. The new houses are better in layout and function than the old, with better-matched facilities and higher earthquake resistance.

There are six living units in Beichuan County in accordance with the norms of city living unit design. Middle and primary schools, kindergartens, entertainment centers, business services, banking, telecommunications, and other municipal public service facilities were established within the living units. Houses were built to meet strict construction and earthquake-resistance standards; and national development policies, such as energy conservation and green architecture policies, were implemented in house construction. The lands required for indemnificatory house construction were given priority and accounted for 46 percent of the planned area.

The area for indemnificatory house construction in Zhuyuan Town reached 99.34 $km^2$, accounting for 12.65 percent of the town's total size. In Hanwang Town, seven living units with 6,345 indemnificatory houses were built. Some of the housing is shown in figure 8.6.

**Figure 8.6 Newly Built Indemnificatory Housing in Hanwang Town, August 201**

Source: Authors.

**Public services improved**

There have been three notable improvements to public services in the areas under discussion.

(1) By September 2011, 18 schools had been established in the three areas to replace the original schools. Ten medical treatment and public health institutes, 31 social welfare institutes, a gerocomium, a community service center, an entertainment center, and a culture center were close to completion. Buildings' security had been enhanced, facilities and equipment had been upgraded, and public service capacity had been strengthened.

(2) Roads and other transportation infrastructure have been transformed and upgraded. There are 13 roadway exits in

New Beichuan County, 6 linked to arterial highways and 7 linked to neighboring towns. A major exit road, Jianqing Road, was upgraded to a second-level road, and Zhuxia Road was upgraded to a third-level road. A second-level passenger service center was launched by Zhuyuan Town, Qingchuan County. Hanwang Town took advantage of an existing railway resource and built a passenger depot along Dea Road, which is near the railway depot. Examples of reconstruction work are shown in figure 8. 7.

**Figure 8. 7 Newly Built Beichuan Road (left) and Hanwang Telecommunications Office (right), August 2011**

Source: Authors.

(3) Disaster prevention and mitigation facilities have been equipped. Eight fixed shelters were built in New Beicuan County, covering an area of 0. 65 $km^2$. The banks of the Anchang River were raised and reinforced according to a once-in-50-years-event flood-control standard. Emergency shelters were also built in Zhuyuan Town, Qingchuan County, and the same flood-control standard for rivers adhered to. The standard for control of flooding caused by mountain torrents is a once-in-20-years-event standard. The antiseismic intensity degree for structures in Hanwang Town was VIII (8); this was raised to IX (9) for important buildings and critical engineering. Evacuation exits and grounds have been left in the township and rural residential area.

**Industries recovered**

With the completion of Feidi Industrial Park, Economy Recycle Industrial Park, and United Industrial Park, many successful enterprises have been attracted to the area, effectively transferring businesses in the east to the west. Many backward enterprises were weeded out. All impaired enterprises in the disaster area have resumed production and most have achieved new levels in production and sales. Manufacture, the service industry, tourism, and other industries have all recovered. Through the twin assistance mechanism, which provided aid from Shandong Province, labor-intensive industries (such as subsidiary agricultural products processing, textile manufacturing, and new building materials) that were suitable for the Beichuan workforce were introduced to Shandong Industrial Park in Beichuan. Machinery, high tech, and other industries compatible with Mianyang's industrial system were also developed. Because Dongqi, the biggest manufacturing company in the county, left the region, Hanwang Town's developmental pattern shifted toward environmental tourism as its supporting industry.

**Environmental improvements**

In the off-site reconstruction process, efforts were made to protect the area's natural resources, ecology, and environment and to create a unified environment comprising mountains, water, and the city. For example, the ecological gallery in New Beichuan County is sited in the Anchang River valley, and a new park is sited on its original water system. In addition, the water system in Meiyuan Town was used to create a public lawn.

## Fundamental Experiences of Off-Site Reconstruction

**Prudent and scientific site selection**

The most prominent advantage of off-site selection is that it fundamentally solves the security problems. Off-site reconstruction following the Wuqia Earthquake in Xinjiang, for example, sustained no damage during three six-plus magnitude earthquakes between 1990 and 1996. Meanwhile, under certain circumstances and conditions, off-site reconstruction may not only solve security problems but also promote development. Some obvious principles should be adhered to in selecting a new site. First, try to avoid seismically active fracture zones or other geological dangers so the city doesn't suffer damage a second time. Second, try to avoid floodplains so the new town doesn't risk being caught in mountain torrents and mud-rock flows.

**Interactive urban-rural development**

In planning for urban economic development, cities' growth should be allowed to drive growth in rural areas. Rural economic development should in turn promote urban development. In this way urban and rural areas come to complement each other and achieve coordinated growth.

**Restoration of town and city function**

The reconstruction work must restore basic services for the affected areas. In the three heavily damaged areas discussed above, this work included construction of indemnificatory housing as well as reconstruction of schools, medical and public health facilities, social security organizations, entertainment venues, party and government offices, infrastructure for water supply and emission, infrastructure for gas and power supply, communications infrastructure, city sanitary infrastructure, underground utilities, shelters, earthquake and flood protection equipment, fire-fighting equipment, and other municipal facilities. Reconstruction work should also be environmentally friendly and seek to conserve energy.

**Protection of traditional culture**

In reconstructing Beichuan, Qingchuan, and Hanwang in off-site locations, great efforts were made to protect traditional cultures so that newly built areas would combine both modern and traditional/ethnic characteristics. The buildings in New Beichuan County are mainly in Qiang style or Qiang-Han combined style, in keeping with the location's status as the only Qiang autonomous county in China. Similarly, Hanwang Town exerted itself to protect religious culture, Mianzhu new-year paintings, and Jiannanchun wine culture.

# 9

## Overall Lessons of Reconstruction

In the aftermath of the Wenchuan Earthquake, a postdisaster reconstruction system with specifically Chinese features came into being. The system was distinctive in including close cooperation between the central government and disaster area governments, a twin assistance mechanism to channel aid to the disaster area, effective coordination between governmental leadership and social participation, rational allocation of financial and other funds, and complementary domestic and international aid. This system aimed to achieve timely, legal, and safe reconstruction based on scientific principles

The following overall lessons of reconstruction emerged:

### An Extensive Scientific Evaluation Is Indispensable

To facilitate an effective and successful reconstruction process, special disaster-evaluation organizations were set up by the State Council, related ministries, and authorities in Sichuan Province, Gansu Province, and Shannxi Province. Using statistical analysis, remote sensing, aerial photography, and other techniques, experts studied the disaster and evaluated its impact. The disaster evaluation identified the disaster's scope, the losses it caused, and natural environment's carrying capacity, which laid a scientific foundation for subsequent planning and reconstruction. Although disaster evaluation required considerable time and labor, it provided an indispensable basis for future restoration and reconstruction work.

### The Reconstruction Plan Should Apply to Future Reconstructions

Regulations on Post-Wenchuan Earthquake Recovery and Reconstruction, which were enacted in June 2008, represent the first regulations concerning postdisaster reconstruction in China. They prescribed the reconstruction plan from the legal perspective. As a guide to the reconstruction process, the regulations made distinct stipulations concerning the responsibility for planning and reconstruction, fund procurement, allocation of funds and goods, and supervision and inspection of the construction projects. Practice confirmed that the principles and working plan contained in the regulations were efficient and in accord with China's situation, current developmental characteristics, and ideals of scientific development. These principles could be used as a reference in similar future reconstruction work. Indeed, the experience gained from the Wenchuan Earthquake reconstruction work was successfully applied in Zhouqu when it suffered a mud-rock flow disaster.

## Reconstruction Requires a Scientific Basis

Because the engineering projects that make up restoration and reconstruction work are large and complex, they require scientific planning. A sound scientific basis for the reconstruction work will mean sound results. The plan should be clear about tasks, responsibilities, and funding and should proceed as follows:

First, the reconstruction tasks and timeline should be articulated; in this case, three years was the original timeline for completing the major reconstruction tasks and raising living conditions and levels of economic and social development above what they were before the earthquake. Second, experts from various fields should participate in preparing the plan, which should be based on extensive preliminary investigation; in this way the rationality of the plan is enhanced. Third, specific plans should be worked out with the guidance of experts, but the overall plan can be determined by the central government. In this case, some planning was also carried out under the twin assistance mechanism, with assisting provinces offering their ideas. Fourth, planning should fully consider future needs and growth, not just restoration of original conditions. Fifth, plans should be flexible and adjusted as needed. Sixth, the plan's scientific emphasis should be applied to enhancing people's livelihoods. In this case, housing reconstruction was emphasized and was carried out expeditiously.

## Funds Should be Collected and Allocated Rationally and Fairly

Self-construction by the affected area, government support, and twin assistance should underlie reconstruction efforts. How reconstruction funds are collected and allocated should be determined fairly, under the requirements of public finance and in accordance with markets and government funds. The rights, responsibilities, and obligations of, as well as distribution of funds to, different subjects should also be fairly determined. Funding is the responsibility of the central government, the affected areas, and other areas, and should come from donors, loans, and funds from residents, enterprises and institutions in the affected area. In this case, funds were collected and allocated efficiently, and reconstruction work did not need to be interrupted because of funding shortages.

## Responsibility Should Be Divided to Optimize Comparative Advantages

The central government, provincial government, and city government should divide responsibility of reconstruction work to optimize the comparative advantages of each. In this case, some departments within the State Council mainly focused on coordinating aid for the restoration and reconstruction process. The provincial-level governments had overall charge of the work, while city-level governments undertook implementation of the major tasks. The rational division of labor and close cooperation between local and central governments contributed to the efficiency of the restoration work.

## The Top Priority Is People's Well-Being

People's well-being is the top priority in scheduling and financing reconstruction tasks. Problems associated with day-to-day living should be solved first. The twin assistance mechanism should give priority to public service and infrastructure projects in order restore normal living conditions as quickly as possible.

## People in Affected Areas Have a Role to Play

In reconstruction, the government plays the leading role; but it takes people's preferences into account on matters of reconstruction style, site selection, room design, engineering supervision, land transfer, and related issues. Where necessary, the government should consult with experts to determine what will best meet people's needs and wishes. In reconstruction of farmhouses, farmers themselves rebuilt houses with government subsidy and social assistance. The government contributed plans and offered various free designs. In urban residential reconstruction, complicated land use and property rights issued meant that flexible approaches to reconstruction ways were adopted; these included self-reconstruction, proprietor reconstruction, and reconstruction managed by the working unit or government. Reconstruction proceeds more smoothly when people's preferences are respected and they themselves assume some responsibility for the process.

## The Twin Assistance Mechanism Works

The twin assistance mechanism worked for four reasons. First, it integrated funds, goods, and intellectual assistance – the last being a very important means of sending experts, medical teaching staff, and other professionals to disaster-affected areas. Second, it enhanced disaster areas' developmental level and capacity in terms both of "hardware" such as infrastructure and "software" such as labor capacity. Third, twin assistance laid the foundation for long-term cooperation, especially industrial cooperation between donor provinces and disaster-affected areas. Fourth, unlike the central government's transfer-payment method, twin assistance is a local transfer-payment method; it frees the central government to focus on the overall reconstruction situation. The twin assistance model is an important model for post-disaster reconstruction and beyond.

## Combining "Blood Transfusion" and "Blood Creation" Enables Sustainable Postdisaster Development

Combining "blood transfusion" (outside assistance for tasks such housing reconstruction) and "blood creation" (fostering of industrial self-development) was adopted mostly in industrial reconstruction, where optimizing economic layout and transforming economic development styles were combined to strengthen already competitive industries and generally speed up industrial reconstruction. The combination was reflected in supporting the poor, protecting the environment, and so on. For example, reconstruction was not undertaken merely to move earthquake victims into new houses, but to offer them the way to a secure life and stable employment.

## Some Limitations in Postdisaster Reconstruction

The restoration and reconstruction work did experience some problems. There were some follow-up funding shortages, when projects not formally included in planning did not receive needed funds. Moreover, the complexity of reconstruction work meant that projects were not always perfectly synchronized with budgets and that some projects were overlooked in allocations.

In addition, follow-up infrastructure and public service maintenance charges increased pressure on financial expenditures by local governments. The postdisaster survey showed that local governments sometimes had trouble meeting the postreconstruction maintenance costs for some reconstructed hospitals, schools, and other facilities that were built to relatively high standards.

There is also some concern about competition in areas where new industries replaced old. For example, several moderately reconst-ructed areas in Wenchuan and Beichuan that turned to tourism in industrial restoration may have resulted in too little industrial diversity and too much competition in one industry.

There is concern, too, that disaster insurance has not been sufficiently exploited. It is common around the world to use disaster insurance for postdisaster reconstruction, but in China, where the insurance industry is not as developed as elsewhere and where many people are unaware of insurance as an option, people generally don't exploit insurance to cope with such this type of disaster. Thus governments and especially the central government were responsible for financing a significant part of reconstruction costs.

Finally, some problems also existed in the operation of the twin assistance mechanism. For example, there was some disagreement between donor provinces and recipients in the calculation of 1 percent of the donor's fiscal income. Some affected provinces held that donations and technical assistance should not be counted toward the 1 percent total, and donor provinces held that they should.

# PART TWO

## Evaluation of Wenchuan Earthquake Postdisaster Reconstruction Efforts:
## Investigative Report on Rural Reconstruction

# Introduction

In May 2008, a severe earthquake occurred in Wenchuan, China. Its effects were felt in Sichuan, Gansu, Shaanxi, Chongqing, Yunnan, and 10 other provinces, districts, and municipalities – that is, over a total area of about 500,000 $km^2$. The magnitude reached 8.0 on the Richter scale, and the maximum intensity reached XI (11) degrees. The earthquake caused many casualties and extensive damage to urban and rural housing and to rural infrastructure. After the earthquake, the Chinese government began to organize and conduct a rapid response to the disaster. Prime Minster Wen Jiabao flew to the affected areas to lead and organize the rescue. On June 4, 2008, the State Council issued Regulation of Wenchuan Postdisaster Recovery and Reconstruction; on September 19 it issued the Overall Plan for Post-Wenchuan Earthquake Restoration and Reconstruction.

With the three-year reconstruction complete, the Chinese government has undertaken an indepth study of the restoration and reconstruction program. The study seeks to highlight achievements and successful experiences – in part so that the Chinese experience and approach with recovery and reconstruction can be compared with experiences abroad – and also to draw lessons from postdisaster recovery and reconstruction that can be an example for countries around the world.

This report focuses on rural infrastructure reconstruction efforts in Sichuan, Gansu, and Shaanxi. All the first-hand information and data were collected from statistical socioeconomic materials provided by relevant government departments as well as through field visits and interviews with government agencies and stakeholders (including residents and officials) in the worst-hit areas. The report establishes a framework for evaluating rural infrastructure reconstruction to facilitate the summing up of lessons and achievements.

The report first analyzes predisaster conditions in affected areas, explains the socioeconomic situation prior to the disaster, looks at any disaster mitigation systems in place, and examines rural infrastructure and production facilities in quake-hit areas.

The report next analyzes the main impacts of the earthquake. This chapter presents the statistical analysis of the impacts on both the natural environment and the rural infrastructure.

The third chapter of the report aims to describe how the Chinese government responded to the disaster and what measures it took for the recovery and reconstruction. This chapter describes

(1) the key objectives of the recovery and reconstruction framework in rural and urban housing construction;

(2) differences between reconstruction planning and regular construction planning;

(3) the reconstruction projects (including classification, size, funding, and progress); and

(4) the measures taken in reconstruction planning (including coordination mechanisms, funding mechanisms, progress control, quality supervision, risk

control, safety management, etc.).

The fourth chapter explains the evaluation methodology, including the main indicators, data resources, and qualitative and quantitative research methods.

The fifth chapter evaluates the recovery and reconstruction activities. It specifically evaluates the program's compliance, efficiency, and effectiveness by comparing results with the original plan objectives. It looks at three questions: the degree to which program objectives translated into benefits for governments and stakeholders; the degree to which program performance achieved expected outcomes; and degree to which resources were used efficiently. It also looks at program progress, quality guarantees, and use of funds, safety management, program cooperation, and risk control. Finally, this chapter also analyzes case studies.

The sixth chapter evaluates program impacts. Rural infrastructure reconstruction has impacts on socioeconomic trends and produces benefits for rural households beyond the ability to cope with future disasters. This section also draws on survey data to analyze the relationship between rural infrastructure reconstruction and new rural building.

In the last chapter, the report highlights the achievements and lessons of reconstruction and indicates issues not yet resolved.

# 1

# Predisaster Conditions

This chapter analyzes the predisaster layout, categories, scale, and levels of rural infrastructure in the areas most affected by the Wenchuan Earthquake (Sichuan, Gansu, and Shaanxi).

## Socioeconomic Status of Rural Areas

According to data from 2007, the growth rate of gross regional product (GRP) in Sichuan, Gansu, and Shaanxi was 11.40 percent higher than the Chinese national average level calculated at comparable price. From 1978 to 2007, the GRP in Sichuan Province experienced fast growth. Especially after 2002, the GRP had an annual growth rate of more than 10 percent, and in 2007, it grew at a rate of 14.5 percent. In 2007, the total gross domestic product (GDP) of the 30 counties severely affected by the earthquake was Y 189.207 billion, 18.01 percent of which was accounted for by Sichuan Province. The growth rate of fixed capital investment in the three provinces was 24.80 percent higher than the national average level.

As for industry structure, the growth rate of primary industry in the three provinces in 2007 was 11.4 percent higher than the average rate among all provinces in China, while secondary industry in Sichuan and Shaanxi both are 22.4 percent higher and tertiary industry in Gansu and Shaanxi both are 16.9 percent higher.

With regard to agricultural development, in 2007 the growth rate of gross output value of agriculture in Sichuan, Gansu, and Shaanxi was 14 percent higher than the national average, and the per capita net income of village residents in the three provinces was continuing to increase. Food production in Sichuan Province amounted to 34.48 million tons in 2007, or 6.9 percent of the Chinese total; and rural employment in the province accounted for 7.2 percent of all rural employment in China.

## Status of Infrastructure in Rural Areas

### Buildings in rural areas

The Chinese government issued the Code for Seismic Design of Buildings (GB50011-2001) in 2001, but this code was applied to buildings in urban areas only. Poor geological conditions, poor economic development, and the practice of villages constructing their own houses are among the reasons that buildings in rural areas did not implement the code.

### Highways and bridges in rural areas

By the end of 2006, the total length of rural highways in Sichuan Province had reached 146,000 km, accounting for 92 percent of total highways in Sichuan Province. Of the 146,000 km in highway, 37,000 km were prefectural highway, 38,000 km were rural highways, 66,000 km were village highways, and 5,000 were reserved for special uses.

**Water-supply status in rural Sichuan**

By May 2005, the total population in Sichuan had reached 85.294 million, of whom 67.341 million were rural residents. The number of residents drinking unsafe water (a category including substandard water and polluted water) was 31.4458 million, accounting for 46.7 percent of all rural residents in Sichuan Province; 59.76 percent of those drinking unsafe water, or 18.7908 million people, drank water of substandard quality.

**Water-drainage status in rural areas**

According to statistics from the Ministry of Water Resources, in 2007 China had 434 large-scale irrigated districts each with at least 300,000mu of irrigated areas under national planning. The total irrigated areas under national planning amounted to 300 million mu, with an effective irrigated area of 247 million mu. Four provinces and autonomous regions – Xinjiang, Shandong, Henan, and Hubei – each owned 20 million mu of effective irrigated areas in large-scale irrigated districts, while Sichuan, Inner Mongolia, Anhui, Jiangsu, Hebei, and Shaanxi owned 10 to 20 million mu. The effective irrigated areas in large-scale irrigated districts in Ningxia, Gansu, and Xinjiang covered more than 70 percent of total irrigated areas in all the provinces (and autonomous regions), while the ratio of effective irrigated areas to the total irrigated areas was between 1 to 3 and 2 to 3 in Inner Mongolia, Shandong, Hubei, Hunan, Sichuan, Shaanxi, and Qinghai. Six very large irrigated districts in these cities each covered more than 5 million mu of planned irrigated areas, including Dujiangyan Irrigated District (11.34 million mu) in Sichuan Province.

**Status of refuse collection, transfer, and treatment in rural areas**

Before the earthquake, some provinces (including Sichuan) had implemented a new and safe method of decontaminating rural refuse that involved collecting refuse from individual households and villages, transferring it to town-level stations, and finally treating it at county-level stations. Although this system was partly damaged in the earthquake, it provided some supporting capacity to the infrastructure facilities and management during reconstruction.

**Rural biogas status**

Thirty-nine of the severely affected counties, districts, and municipalities had 1.2038 million rural household biogas digesters and 384 middle- and large-scale biogas projects on farms.

## Status of Production Facilities in Rural Areas

**Direct facilities for agricultural production**

According to statistics on land use and exchange in 2007, the total areas of land in the 51 affected counties, districts, and municipalities covered 13.2425 million hectares; of this area, agricultural land covered 12.0159 million hectares, accounting for 90.7 percent of the regional land areas. Construction land accounted for 435,400 hectares, or 3.3 percent of the area, and unused land accounted for 791,200 hectares, or 6.0 percent.

Food production in Sichuan in 2007 amounted to 34.48 million tons, representing 6.9 percent of total national food production. Sichuan was the top province in hog breeding and pork production that year, with 99.11 million hogs. The agricultural acreage in severely affected areas was 19,818.2 hectares, 22.3 percent of which was in Sichuan Province.

Among Sichuan's agricultural production facilities were 19,000 km of drainage ditches for farming land, 372,400 reservoirs, 94,900 mountain ponds, 23,019 electromechanical irrigation facilities that produced 542, 500 kW, 103, 500 km of tractor roads, 1. 2134 million sets of farm machinery, garages for machinery amounting to 2. 286 million $m^2$, agricultural production greenhouses amounting to 204. 53 million $m^2$, greenhouses for silk-worms amounting to 8. 595 million $m^2$, 129. 0767 million $m^2$ in livestock and poultry sheds, and an area of 1. 17 million mu for aquaculture.

**Breeding system for improved agricultural varieties**

Before the earthquake, the bases for livestock breeding and improved crop production in the affected area were concentrated in Sichuan Province. Breeding bases covering 403, 000 mu and annual seed production amounting to 93 million kg, accounting respectively for 50 percent and 70 percent of those in the whole province, were located in the affected area.

**Agricultural technology service system**

Before the earthquake, Sichuan had six agricultural research institutes and other technology-development service agencies in the fields of agriculture, forestry, animal husbandry, aquaculture, and farm machinery operating in most of its municipalities, counties, and villages. The counties and villages had a total of 2. 1753 million $m^2$ of office buildings and 1. 5655 million sets (units) of instruments and equipment for business and examinations.

**Production facilities in state-owned farming**

Before the earthquake, Sichuan had 40 state-owned farms covering 325, 000 mu and buildings with an area equal to 314, 000 $m^2$.

## Chapter Summary

In the areas the earthquake hit hardest, economic development was stable before the earthquake, and the growth rate of main economic indicators was higher than the national average. But judging from their share of gross production relative to that of the whole nation, they were still considered less-developed areas.

Data indicate that the production and living conditions in these quake-hit rural areas were generally stable, but that infrastructure was weak.

# 2

# Impact of the Earthquake

This chapter analyzes the impact of the Wenchuan Earthquake, including its impact on the natural environment, rural infrastructure facilities, and the social environment. This account serves as the foundation for understanding the reconstruction goals described in the next chapter.

## Impact on Nature

### Topographic change

The quake-hit areas in Sichuan were an important ecological barrier for the upper reaches of the Yangtze River, an area with abundant species diversity and a complex ecological environment. Given its magnitude (8.0 on the Richter scale) and maximum intensity (XI [11] degrees), this shallow-focus earthquake was enormously harmful to the area's plants, rare animals, and topography.

### Damage to ecological environment

The earthquake caused critical damage to the ecological environment. It affected a number of ecological counties (those where the social economy and natural environment were developed harmoniously), including Wenchuan, Beichuan, Qingchuan, Maoxian, Jiuzhaigou, and Pingwu; situated within the Longmen Mountain district, these counties were all covered by forests and had always played a role in regulating the climate in southwest China and in maintaining the condition of soil and water in the middle and upper reaches of the Yangtze River. The earthquake destroyed the forests, and hence their climate-regulating capacity, and also severely damaged the environment for animals and plants. Frequent secondary disasters such as mud-rock flows posed an even more serious threaten to the environment.

### Impact on natural landscape and historical and cultural heritages

According to an internal report by the State Seismologic Bureau, the areas affected by the earthquake are home to 93 scenic resorts and six world heritage sites (of which four sites are also considered scenic resorts). Preliminary statistics suggest that 64 scenic resorts were damaged in the earthquake, or 67.4 percent of the total resorts in the quake-hit areas.

## Impact on Social Economy

The Wenchuan Earthquake dealt a strong blow to economic development in the region, leading to direct losses as high as Y 843.77 billion, with losses in Sichuan accounting for 91.3 percent of this amount, losses in Gansu amounting to 5.8 percent, and losses in Shaanxi amounting to 2.9 percent. Although it did not impede macroeconomic development, it caused very significant economic damage to productivity and inventory in the quake-hit areas.

## Physical Damage to Rural Infrastructure

The Wenchuan Earthquake caused enormous damage to rural areas. Many villages were razed to the ground; the living and production infrastructure was destroyed; the capacity of rural public service and agricultural production was damaged; a large number of rural residents lost their homes, farms, and livelihoods; and the poor grew in number and fell into deeper poverty.

Specifically, the following infrastructure and facilities were damaged: 220, 000 km of in-village highways; 68, 200 bridges, culverts, and tunnels; 411, 400 water-supply facilities; 12, 700 km in drainage pipes; 3, 757 refuse collection stations; 28. 6826 million $km^2$ in production greenhouses; 424, 100 household biogas digesters; 106 large or medium-size biogas digesters; 29. 6288 million $m^2$ in livestock and poultry sheds; 6, 900 hectares in fishponds; and 94, 200 sets of farm machinery. The earthquake also damaged the rising agro-technology sector and state-owned farms.

## Physical Damage to Production Facilities

Seriously damaged production facilities included farmlands, forests, fishery breeding ponds, livestock and poultry sheds, production greenhouses, irrigation stations, tractor roads, agricultural machinery garages, breeding bases for improved agricultural varieties, the agrotechnology service system, and state-owned farms.

**Damage status of farmlands**

An area of 137, 400 hectares (2. 06 million mu) of farmland was damaged in the earthquake, representing 7. 33 percent of that in Sichuan Province prior to the earthquake. An area of 11, 800 hectares (176, 900 mu) of farmland, representing 0. 63 percent of farmland in Sichuan Province prior to the earthquake, was totally destroyed and rendered unsuitable for future planting.

**Damage status of forestry**

The Wenchuan Earthquake caused severe damage to forests, forest lands, wildlife, the forestry service system, and ecological protective facilities. The damage in the 39 most severely affected counties, districts, and municipalities involved 4. 921 million mu of forest lands; 24, 000 mu of forest seeding bases, seed-collecting bases, and seed production stands; 253, 000$m^2$ in greenhouses; the main areas for ecological construction and protection, including nature reserves, state-owned forest farms, and forest industry groups; and the forest service system, including forestry workshops, wood inspection stations, and technology popularization stations. Other damage included 1, 830 km of forest-only highways, 2, 672 km of sidewalks for fire prevention, 230 watch towers for fire prevention, 5, 807 km of hydroelectric telecommunication lines, 67 power stations, 38, 000 $m^2$ in wildlife sheds, 772, 000 $m^2$ in production buildings, and 1. 19 million $m^2$ in employee housing, as well as 11, 000 sets of equipment for fire prevention, transportation, office work, and monitoring. Total losses amounted to Y 17. 66 billion.

**Damage status of animal husbandry**

The death of livestock and poultry caused a loss of Y 6. 99196 billion. Losses included 33. 83 million head of livestock and poultry, including 306, 700 large animals representing a financial loss of Y 1. 10911 billion, 3. 4033 million pigs at a loss of Y 4. 42135 billion, 584, 900 sheep at a loss of Y330. 42 million, 25. 5476 million in poultry at a loss of Y 696. 33 million, and 3. 9875 million in rabbits at a loss of Y 434. 75 million. The area of damaged sheds was 2, 882. 32 $m^2$, amounting to a loss of Y 10. 12853 billion.

**Damage status of management and service system**

The damaged buildings in the Department of Animal Husbandry in Sichuan Province amounted to 996, 400 $m^2$ and collapsed buildings to 449, 000 $m^2$, for a total loss of Y 1. 301 billion. The loss of epidemic-prevention supplies, inspection and quarantine equipment, and the cold chain (temperature control) system reached Y 244. 51 million. In the 18 most severely affected counties, the damaged buildings covered 228, 400 $m^2$ and the collapsed buildings covered 247, 400 $m^2$, for a loss of Y 189, 390. Loss of equipment and the cold chain system came to Y 189. 39 million. The share of buildings damaged by the earthquake was 22. 93 percent, the share of collapsed buildings was 55. 11 percent, the share of equipment lost was 42. 19 percent, and the share of the cold chain system lost was 77. 46 percent.

**Damage status of irrigation and drainage**

Equipment for irrigation and drainage was damaged in 1, 174 irrigation districts (4 large, 45 medium-size, and 1, 125 small districts). Damaged equipment and infrastructure included 22. 5 km of drainage channels, 35, 300 water intake structures with irrigation and drainage channels, 59, 200 mountain ponds, 4, 332 Shihe ponds (designed to intercept stream runoff), 3, 447 irrigation stations, and 62, 800 water conservancy microfacilities affecting 7. 85 million mu of irrigated lands. The earthquake also damaged 4, 373 rural hydroelectric power stations with a capacity of 3. 95 million kW, 20, 800 km of transmission lines, 4, 373 sets of equipment for power transmission and distribution, 100, 800 mu of ponds, 175, 400 $m^2$ in buildings for production, 16, 700 $m^2$ in aquacultural popularization areas, and 26, 000 tons of fish and small fry, for a total loss of Y16. 673 billion.

**Damage status of breeding system to improve varieties**

The earthquake affected 172 farms for breeding livestock and poultry, including 114 hog farms, 2 cattle farms, 2 sheep farms, 33 poultry farms, and 18 rabbit farms; 216, 000 head of livestock and poultry were affected altogether. The area of sheds damaged amounted to 269, 017 $m^2$; of this, 73, 446 $m^2$ represented collapsed sheds, for a total loss of Y 120 million. In the six most severely affected municipalities, there was damage to 93 farms for breeding livestock and poultry, including 56 hog farms, 1 cattle farm, 2 sheep farms, 17 poultry farms, and 17 rabbit farms; the total number of lost livestock and poultry was 131, 000. The damaged sheds covered 188, 716 $m^2$; of this, collapsed sheds represented 64, 955 $m^2$, for a total loss of Y 81. 967 million.

**Damage status of agro-technology service system**

The earthquake damaged 56 municipality-level and county-level agrotechnology service stations, 1, 271 village-level agrotechnology service stations, and four agrotechnology research institutes.

**Damage status of production facilities on state-owned farms**

Facilities on state-owned farms suffered varying degrees of damage. Thirty-seven buildings for business use and 993 mu of farmlands were harmed, as well as roads, drainage channels, electrical supply lines and telecommunication lines, small reservoirs, water tower, pipes for water supply, and auxiliary facilities.

## Physical Damage to Impoverished Villages

The living conditions and productivity of village residents were seriously affected by the Wenchuan Earthquake. The impoverished population increased following the disaster, and the degree of poverty was aggravated. For example, 675 villages under the poverty line in Guangyuan were seriously damaged, and 35 villages were added to the ranks of those considered impoverished. In Guangyuan, 506, 300 people, or 20. 7 percent of the population, were below the poverty line in 2009, up from 13 percent of the population in 2007. The percentage of people in Guangyuan living in poverty in 2009 was 14. 2 percent higher than in Sichuan Province as whole and 16. 3 percent higher than in all of China.

## Chapter Summary

The Wenchuan Earthquake was among the worst disasters in China's history. It caused enormous damage in Sichuan, Gansu, and Shaanxi, and was especially harmful to the regional economy and to economic development. But the earthquake had only limited impact on Chinese GDP as a whole.

After the earthquake, people experienced great difficulties and challenges in their living and working conditions. Rural areas were gravely damaged, and the poor population increased as villages that had not been designated poor before the earthquake became poor as a result of it.

# 3

# Recovery and Reconstruction Plan

This chapter describes the Chinese government's quick response to the Wenchuan Earthquake and looks specifically at the goals and requirements of the recovery and reconstruction plans as they relate to rural reconstruction.

Seven days after the Wenchuan Earthquake struck, the Chinese government initiated the planning work for reconstruction. Planning for 10 projects, including overall planning, housing construction in urban and rural areas, and village construction, was completed in three months, as expected. On May 19, 2008, the Sichuan provincial government initiated rescue planning work; later, at the end of May, it established a postdisaster reconstruction planning team under the leadership of the Sichuan governor. The team took full responsibility for coordinating the planning work.

## Planning Goals

**Overall planning of postdisaster recovery and reconstruction**

The plan for postdisaster recovery and reconstruction had multiple components.

(1) Planning basis. The Chinese government sought to organize reconstruction so that it would be maximally effective and would restore normal economic and social development as quickly as possible. At the direction of the State Council, and guided by two laws,[1] the National Development and Reform Commission (NDRC) took steps to get planning underway. It coordinated relevant departments in the State Council and provincial governments in the quake-hit provinces, and issued the Overall Plan for Post-Wenchuan Earthquake Restoration and Reconstruction to guide reconstruction and recovery work after the disaster.

(2) Planning scale and features. The massive earthquake that hit Wenchuan affected 417 counties, cities, and districts in ten provinces, autonomous regions, and municipalities. It affected a total area of 500,000 km$^2$. The scope of overall planning covered 51 severely affected districts in Sichuan, Gansu, and Shaanxi Provinces, whose total area was 132,596 km$^2$; in this area were 1,271 towns and villages and 12,565 executive villages. At the end of 2007, the total population of the overall planning area was 19.867 million, and the gross regional product was Y 241.8 billion. The per capita

1 The Law of the People's Republic of China on Protecting against and Mitigating Earthquake Disasters, Regulations on Post-Wenchuan Earthquake Reconstruction and Restoration (SC No. 526); and State Council Guidance on Post-Wenchuan Earthquake Reconstruction and Restoration (NDRC [2008] No. 22).

disposable income of urban residents and per capita net income of rural residents were respectively Y 13, 050 and Y 3, 533.

The planning area is mainly located in the transitional terrain from the

Qinghai-Tibet Plateau to the Longmen Mountains area of the Sichuan Basin.

The western terrace of the Longmen Mountains differs from the eastern, both in terms of geology and the level of socioeconomic development. Among its distinctive characteristics are these:

- Complicated topography, with plains, hills, plateaus, and mountains; alpine gorge areas with diversified distinctive height differences and climate differences in some areas.
- Frequent natural disasters and high risk of disasters caused by intertwining fault zones; widespread, large-scale, and serious threat of geological disaster risks such as landslides, mudslides and mud-rock flows.
- Fragile ecological environment with scattered farmlands and serious soil erosion; enormous diversity of wildlife and ecological systems; important ecological barrier for the upper reaches of the Yangtze River and important habitat for rare and endangered species of wild animals.
- Abundant in tourist and other resources, with natural and cultural heritage sites and nature reserves, water resources, nonferrous metals, and nonmetal mines.
- Weak economic foundation; higher level of industrialization in plain and lower in plateaus; single industrial structure and low income.
- Inhabited by ethnic minorities, including Zang people. The sole area inhabited by Qiang people. Multiple cultures and unique historical and humanitarian resources.

(3) Planning goals. The plan specifies that three years be spent in accomplishing the main reconstruction task and ensuring that fundamental living conditions and socioeconomic development reach or exceed pre-earthquake levels. It also calls for simultaneous efforts to build new and harmonious communities for people in the affected areas and to lay a solid foundation for sustainable economic development.

**Planning for postdisaster reconstruction in rural areas**

To arrange specifically for rural reconstruction after the earthquake, a document entitled Planning for Post-Wenchuan Earthquake Restoration and Reconstruction in Rural Areas was issued. It articulated the following aims: to accomplish the main reconstruction task in rural areas in three years; to improve agricultural production facilities and infrastructure facilities; to bring agricultural production capacity, agrotechnological supporting capacity, and the capacity for public service in rural areas back to or above pre-earthquake levels; to improve the living and working conditions in poor villages; and to lay a solid foundation for realizing the objectives of poverty relief and economic development.

## Overall Planning Principles

**Plan priorities**

Under the principle of "people-oriented governance," the overall planning document accords high priority to livelihood matters, while also requiring respect for nature and adherence to a scientific outlook. The plan calls for all these factors to be taken into consideration in further planning, and specifies that mechanisms for cooperation and innovation should be built up in order to promote coordinated development. Safety and quality are also to be assured in reconstruction. Measures to spur economic development should be pursued while protecting farmland, cultural heritage, and the natural environment. All these principles and measures are to be taken in steps and in accordance with local circumstances.

**Guiding ideology**

The guiding ideology for rural reconstruction includes the following goals:

- Comprehensively implement the scientific approach to development and adhere to the principles of people-oriented governance, respect for nature, and scientific reconstruction.
- Take all factors, including the bearing capacity of the resource environment, into consideration in order to ensure people's security and livelihood.
- Emphasize a combination of reconstruction, comprehensive rural reform, new rural construction, and poverty alleviation in order to restore agricultural production facilities, improve the living environment, and increase villagers' income in rural areas.
- Develop modern agriculture and rural public service to provide a foundation for sustainable development of agriculture, prosperity, and stability in rural areas and to promote villagers' well-being.

**Summary of rural planning principles**

In sum, planning for rural reconstruction projects stresses the priority of people's livelihoods and security, scientific reconstruction suitable to local conditions, preservation of cultural heritage and prominent local characteristics, use of creative mechanisms and coordinated construction, protection of farmland, and sustainable development.

## Planning Details

**Reconstruction of living facilities in rural areas**

The plan for reconstruction of rural living facilities gives priority to the reconstruction of basic living and production facilities, which are of greatest concern to the rural residents in affected areas. Where they can be done safely at the original site, repair and reconstruction should be the first projects to go forward. When infrastructure construction occurs in a new location, the plan gives consideration to the production mode and living habits of local people; determines the order and priority of projects according to their necessity, benefit, and affordability; and implements them in a safe, economical, and convenient way.

*Village highways*

The plan specifies that full use of original roads and facilities should be made, and that any partial reconstruction and new construction should minimize the damage to the regional ecological environment. The reconstructed highways in the villages reach 40,000 km, of which 9,000 km are newly built and 31,000 km are reconstructed. There are 412 bus stations are under reconstruction, including 49 at the county level and 363 at the village level. According to the plan, highways connecting to towns and executive villages should take priority in reconstruction. Under certain conditions, towns may use asphalt pavement and executive villages may build highways. The breadth of roadbed to the villages should be no less than 4.5 m. Bus stations are to be built step by step depending on conditions. The plan dictates that reconstruction should avoid use of farmland, destruction of plants, interfering with drinking water supplies, spoiling of grounds, and dumping in rivers, reservoirs, and barrier lakes.

*In-village roads, bridges, and culverts*

For safety and practical reasons, the plan calls for rocks to be cleared away and the destroyed roads, bridges, and culverts repaired and strengthened.

According to the plan, roads should be reconstructed on the basis of the original ones, though some new roads may be built if doing so does not interfere with the safety and convenience of villagers. Repairs to and reinforcement of bridges and culverts should meet the requirements of earthquake-resistance and flood relief and should base their structure and length on the original live load scale. The plan also indicates that construction of bridges and culverts should be in accordance with the relevant engineering qualifications.

*Water supply*

Village water-supply systems may be either centralized or decentralized; these two types of systems provide water to 8.607 million people in reconstructed villages, new rural construction, and temporary dwellings. About 6,200 centralized systems provide water to 5.8675 million people, while 275,100 decentralized systems serve 2.7391 million people.

The plan specifies that villages with dense populations, if qualified, should build a system of centralized water supply with other qualified villages. Unqualified villages should build village-centered (decentralized) water-supply systems. Scattered villages should introduce projects like water diversion projects, sand basins, trash racks, outlet pipes, reservoirs, and wells. All water-supply systems in reconstructed and newly built villages should be constructed on the basis of relevant technological qualifications and avoid secondary pollution to the drinking water in the affected areas.

*Drainage*

According to the plan, local natural conditions and capacity for recycling and purification should be used to promote natural drainage of rain water and gray water; capacity for self-purification should not be exceeded. Nine thousand kilometers of drainage channels should be built.

Where feasible, qualified villages should consider hooking into the gray water treatment facility of a nearby town. If not qualified, they should build a gray water treatment facility on their own or with other villages. Where septic tanks are widely used, wastewater could be processed and used in fields again, and other scattered wastewater treatment systems (like land treatment, artificial wetland, and anaerobic biological filter systems) could also be used to deal with gray water and wastewater. Villages should build rainwater drainage systems to accommodate surface runoff and ditch runoff.

The villages rebuilt on their original sites, the plan indicates, should focus on restoring original capacity of drainage and gray water treatment. New villages built on other sites should build drainage systems and choose suitable gray water treatment facilities in accordance with planning and practical conditions.

*Refuse collection, transfer, and treatment*

Under the plan, the treatment of rural refuse should concentrate on timely recycling and fertilizing to keep the villages clean. There are 15,800 refuse collection and treatment facilities that need to be reconstructed to implement 750 village cleaning projects.

The system recommended for villages located in the plain areas and in counties with dense populations is for refuse to be collected by a village station, transferred to a town station, and treated by a county station that incorporates nearby villages and towns. Scattered residents in areas poorly served by transportation are required to bury refuse or use it to fertilize farmlands. Where warranted, refuse collection facilities should take sanitary measures to prevent secondary pollution. Villages built on the original sites should rebuild refuse collection facilities, and villages built at new locations should build comprehensive garbage-refuse collection facilities in accordance with planning.

The plan specifies that construction debris, especially when it is scattered or the quantity is small, should be sorted and disposed of at the original location. Useable construction materials should be used in the construction of farmhouses and auxiliary buildings. Comparatively concentrated constructional debris in large amounts should be collected and treated by the county or by district facilities, depending on investigation and evaluation.

*Construction site leveling*

The plan indicates that construction sites, with a total area of 66,000 hectares, should be leveled to facilitate construction layout, planning, and design and to satisfy the requirements of engineering construction, pipe layout, and flood mitigation and drainage.

The leveling on the new rural construction should be conducted so as to minimize damage to the existing geological features.

*Biogas*

The plan encourages village residents to improve energy-use methods and rebuild biogas digesters. Some 430,000 biogas digesters will be reconstructed, including 157,000 newly built, 162,000 restored, and 111,000 buried. One hundred and six large and middle-size biogas digesters will be rebuilt for farms, and several small digesters and 1,235 service stations will be rebuilt for 250,000 farmers.

**Reconstruction of agricultural production facilities**

The reconstruction of agricultural production facilities, the plan states, should focus on the recovery of production facilities for crops, livestock, and poultry; facilities for breeding improved varieties; the agro-technological service system; and state-owned farms. It should integrate the technological service stations at different levels, rationally schedule the construction process, and arrange resources (funds and labor) to effectively restore agricultural facilities and equipment.

*Agricultural production facilities*

The plan calls for reconstructing 100,500 hectares of farm land containing damaged fields, terraces, and drainage facilities, as well as facilities for reservoirs, irrigation of dry lands, and cultivation. The reconstruction projects include 28.8 million $m^2$ of greenhouses and similar structures, of which 25.61 million $m^2$ are for growing edible fungi and vegetables, and 3.19 million $m^2$ are for breeding silkworms.

It also calls for the reconstruction of 22.11 million $m^2$ of livestock and poultry sheds, reconstruction of 12,300 hectares of fishery breeding ponds, and new construction of water intake and outtake channels and buildings for production.

Reconstruction of 9,982 irrigation stations is required. The plan focuses on building pump rooms and water intake and outtake channels, and on maintaining and resetting the equipment in the irrigation stations and agricultural electrical wells. Reconstruction is also required for 238,000 $m^2$ of machinery garages and 18,392 km of tractor roads, including surfaces, roadbed, bridges, culverts, and security facilities.

*Facilities for breeding improved varieties*

The plan calls for reconstructing 79 crop breeding farms, including office buildings, facilities, net rooms, and auxiliary assets; 141 livestock and poultry breeding farms, including sheds, facilities for epidemic prevention, and hydroelectric facilities; and 32 aquaculture breeding farms, including breeding facilities, roads, walls, water intake and outtake channels, and buildings for production.

*Agro-technological service system*

The plan calls for reconstructing 1,327 agro-technological service stations (centers) – including 5 at the municipal level, 51 at the county level, and 1,271 at the village level – and four agro-scientific research institutes. The work involves rebuilding offices, resetting and supplementing existing instruments, and (for the research institutes) repairing experimental fields and tunnels.

*State-owned farms*

According to the plan, 37 state-owned farms should be rebuilt, including 137,200 $m^2$ of buildings, 993 mu of farmland, 143 km of roads, 73.7 km of drainage channels, 44.1 km of electrical supply lines and telecommunication lines, 60 small reservoirs, 20 water towers, 36.4 km of pipes for water supply and drainage, and 1,445 sets of equipment.

**Reconstruction of impoverished villages**

Recognizing that impoverished villages have relatively low capacity for recovering after a disaster, the plan calls for additional funds to support accelerated recovery of their infrastructure and production capacities.

Funds will be given to 4,834 impoverished villages to reconstruct homes and production facilities, including neighborhood roads, in-home electrical supply facilities, small drinking-water facilities, clean energy facilities, and farmland. The plan encourages 2,048 villages to establish a fund that would provide startup capital to 564,900 poor families. It also specifies training for 534,300 laborers and practical technological training for 400,000 poor families.

Funds will be provided to 240,000 poor families to improve their living conditions by means of the "five improvements and three constructions" policy, which aims to improve the condition of houses, kitchens, washrooms, water-supply systems, and roads, and to facilitate construction of pods, gardens, and homes.

## Mid-Term Adjustment

Postdisaster reconstruction is a complex systemic project, and the overall plan specifies that the NDRC should evaluate it at mid-term. On August 31, 2009, the NDRC authorized the International Consulting Company of China to conduct a mid-term evaluation of implementation of the overall plan and 10 special plans. A mid-term adjustment was made on the basis of the evaluation. After the adjustment, the pace of reconstruction increased and the process became more efficient. The adjustment was particularly helpful in the following ways:

(1) It better aligned planning with practice, while continuing to emphasize respect for nature and reliance on scientific principles.

(2) It clarified what was most important. The mid-term adjustment deleted unnecessary parts from the overall plan and enhanced its key aspects. Some originally omitted projects were added, some projects were removed, and some integrated with one another.

(3) The adjustment made the planning more rigorously scientific as well as realistic. It ensured that the original objectives would be met by addressing the problems that arose during implementation, while also taking future development into consideration.

## Implementation and Protection Measures

**Funding demand and finance**

According to the initial evaluation, postquake restoration and reconstruction in rural areas would cost more than Y 97 billion and would be financed by the government, nongovernmental organizations, emergency loans from other countries, and self-financing by local governments. In addition, the Party Central Committee and the State Council coordinated a program ("twin assistance") that matched 18 quake-hit cities and counties with 18 donor provinces, each of which would provide its counterpart with financial and other aid.

Reconstruction in rural areas faced three obstacles. First, the poor villagers did not have enough money to pay for reconstruction themselves, so multiple funding channels were needed. Second, villagers lacked the funds for reconstructing infrastructure. Last but not least important, the villagers were not accustomed to thinking about long-term risks and risk prevention.

Funds for rural housing reconstruction were raised from several sources, including government (both central and local), banks, all societal groups, and the villagers themselves. Funds for reconstruction of infrastructure came from twin assistance funds, funds for poverty alleviation, funds for environmental protection from the central government, special Communist Party membership dues for assistance, and work-relief funds. Where official funding channels could not meet the demands of reconstruction, multiple investment systems engaging all available capital were established, including private capital (repaid to society from those who worked in other cities, or private capital investment in reconstruction) and entrepreneurial capital.

The village of Jishanba provides an instructive example of how reconstruction was funded. Because of the limited economic capacity of local villagers, each set of houses was designed with an area of 90 $m^2$, at a total cost up to Y 70,000. Of the Y 70,000, Y 20,000 came from the government, Y 20,000 came in the form of interest-free bank loans, and Y 20,000 came from twin assistance, leaving only Y 10,000 to be raised by the villagers themselves.

Another example is offered by the village of Xuanmawan, which is located in a beautiful natural setting. This village was aiming to develop rural tourism, so houses were designed with two floors, one for the owners and the other for tourists. This kind of design increased building costs to as high as Y120,000, which was financed as follows: Y 20,000 from the government, Y 20,000 from interest-free bank loans, Y 20,000 from twin assistance, and Y 60,000 from the villagers themselves. With the leadership and help of local officials and nongovernmental teachers, the villagers learned management techniques and concepts. They have gradually developed a rural tourism industry and will be able to pay back loans and support long-term development.

A couple of final examples of the various methods used to pay for rural reconstruction: the village of Sanguanmiao in Wenchuan introduced special party-membership dues to fund a villagers' activity center, while Jishanba relied on a poverty alleviation fund to establish a shelter for villagers in quake-hit areas and on a central government environmental protection fund to pay for facilities for garbage collection.

**Duties of central and local governments**

The central and local governments and party committees should conduct the whole reconstruction program and coordinate efforts to involve all stakeholders in order to optimize the comparative advantages of each.

**Relevant beneficiaries**

With a view to coordinating the efforts by all sectors of the community, the central government identifies each sector's duties in the reconstruction and also provides necessary relief payments to affected people. At the same time, under the leadership of the government, people affected by the earthquake voluntarily involve themselves in the reconstruction of their own homes, including doing the building themselves, financing the work themselves, and so on.

In line with the principle of "government leadership, full community participation," people have a primary role to play in reconstruction, management, and supervision, even as they receive financial and other support from the government. The government offered Y 20,000 as an allowance for the construction of permanent housing – distributed according to the stage of the projects – and showed concern and support to try to eliminate the pessimistic mood. A reasonable allocation of public services at demonstration spots should encourage rural residents to voluntarily build their houses in planned locations and improve the quality of their home and work environments.

The government has enacted favorable taxation measures to help both collective enterprises and individual farmers. According to the Notice on Taxation in Antidisaster and Reconstruction, issued by the Ministry of Finance and State Taxation Administration, enterprises may deduct losses caused by the earthquake from the calculated tax. Individual farmers who suffered losses in the earthquake are also taxed at a lower amount. Individuals in the disaster-hit areas are not taxed on their pensions or on relief payments.

## Chapter Summary

The goal of the overall reconstruction plan was to finish the main task in three years, ensure that basic living conditions and socioeconomic development reach or surpass their levels prior to the disaster, and build a harmonious new homeland as a solid foundation for sustainable economic and social development.

The goal of rural reconstruction was to finish the main task of reconstruction in rural areas in three years, improve rural production facilities and infrastructure facilities, and ensure that the capacities of agro-production, agro-technology, and agro-public service meet or surpass their levels prior to the disaster. A further goal was to improve the living conditions in impoverished villages with the aim of further poverty alleviation in the future.

Rural reconstruction is complex and various. Planning therefore emphasized the duties of all departments and identified the coordinative mechanism among them. As a result of the mid-term adjustment to the plan, reconstruction was made more rational and was carried out more quickly.

# 4

# Evaluation Methodology

## Overall Explanation of Evaluation Methodology

The evaluation described in this report used multiple qualitative and quantitative research methods, including the following:

- **Document analysis**. The report analyzes reconstruction documents and policies issued by different levels of government and government departments to understand the policies' tendency and the main factors affecting the efficiency of reconstruction.
- **Questionnaire**. The report analyzes the results of questionnaires given to both officials and the public in order to learn about the implementation of policies and about the degree to which people were satisfied with reconstruction, as well as to make some inferences about the relationship between rural residential reconstruction and new rural construction.
- **Investigation of quake-hit areas**. The report analyzes data, pictures, and information obtained first-hand during visits to the affected areas by means of face-to-face communication and in-depth interviews with local governors and members of the public.
- **Case study**. The report draws on 9 typical cases in analyzing the practical effect of reconstruction.

Two of the methods – the questionnaire and the case study – are described in more detail below.

## Questionnaire

As part of an effort to obtain first-hand data about postdisaster reconstruction, the project group from the Economic Management Research Institute of Sichuan College of Architecture Technology conducted a survey about the process and consequences of housing reconstruction in rural and urban areas and of village reconstruction. The survey was administered from March to May 2011 with assistance from the Sichuan Fiscal Ministry, the Sichuan Construction Ministry, and departments responsible for reconstruction in the various quake-hit districts.

Survey sampling was carried out over two months in 10 cities and counties in Sichuan Province that had been hit by the earthquake. Samples were drawn from different blocks and levels. Block samples were taken from four cities (Mianzhu, Shifang, Dujiangyan, and Pengzhou) and six counties (Wenchuan, Beichuan, Qingchuan, Maoxian, Anxian, and Pingwu). Level samples were taken from officials at different levels and members of the public. The whole sample covered 30 cities and counties and 50 executive villages and involved 700 quake-hit households.

Seven hundred surveys were delivered, and 649 were returned (265 from cities and counties and 384 from villages), for a return rate of 92.7 percent.

The research group designed five different questionnaires that addressed five broad categories:

(1) Questionnaire about rural and urban residential construction after the earthquake (for residents). This questionnaire addressed 11 areas, including types of reconstruction, funding, people's preferences concerning reconstruction, measures for reconstruction, people's satisfaction with reconstruction, and people's difficulties with and suggestions about reconstruction.

(2) Questionnaire about reconstruction in rural areas (for officials). This questionnaire addressed 10 areas, including types of reconstruction, planning, mechanisms for decision making, mechanisms for supervision, and questions and problems from officials at the grassroots level.

(3) Questionnaire about reconstruction in rural areas (for residents). This questionnaire addressed 11 areas, including respondents' degree of satisfaction with production conditions (land, agricultural mechanical equipment, technical support for agriculture) and living conditions (drinking water, disposal of garbage, roads).

(4) Questionnaire about the relationship between reconstruction in rural areas and the construction of new villages (for village officials). This questionnaire asked respondents to compare reconstruction in rural areas and the construction of new villages in respect of their effect on development, living standards, cultural and moral traditions, village appearance, and so on.

(5) Questionnaire about the relationship between reconstruction in rural areas and the construction of new villages (for village residents). This questionnaire asked respondents to compare reconstruction in rural areas and construction of new villages, specifically focusing on the emphasis of construction and on construction's effect on income levels, living conditions, transportation, and related concerns.

## Case Study

The research group divided the quake-hit areas into different blocks based on the area's fault zone structure, including mountains, hills, and plain, and then picked nine typical districts to analyze. The nine districts (shown in figure 4.1) are Yangliu Village in Taiping County of Maoxian, Laojie Village in Yingxiu Town of Wenchuan, Mazu Village in Sifang City (all in Sichuan); Jishanba Village in Chengxiandian County, Xuanmawan Village in Nianba County of Kangxian, Weizigou Village in Huangchen County of Chengxian, Xin Village in Diancunzhenof Cheng County (all in Gansu); and Shangping Village in Xujiapingzhenof Lueyang County and Dongli Village in Yanzibian Town of Ningqiang County (both in Shaanxi).

## Chapter Summary

This report relies on five research methods, which include both qualitative and quantitative approaches. The major research methods include questionnaires and individual-case analysis.

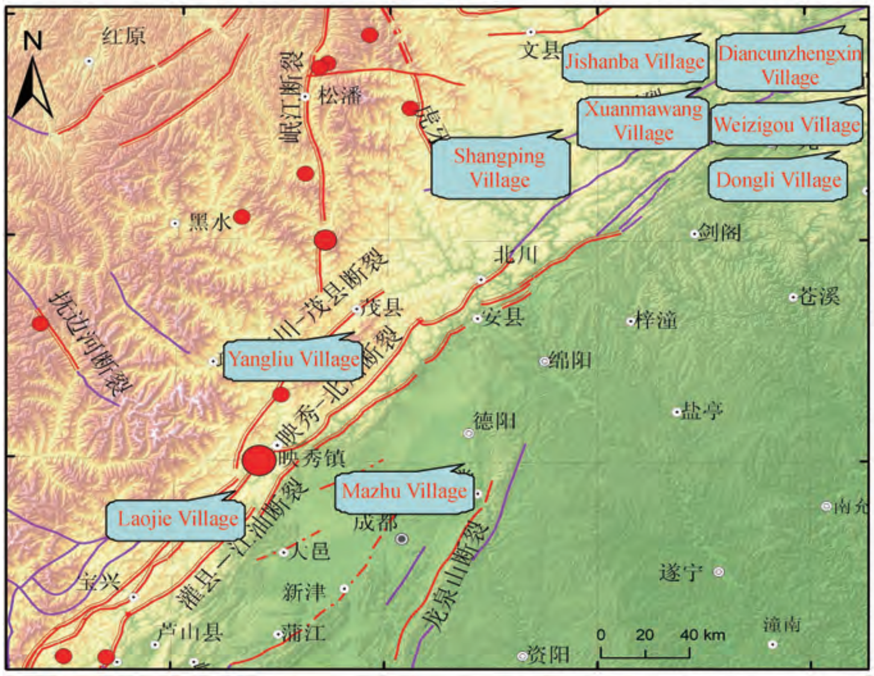


**Figure 4. 1 Distribution of Individual Cases for Case Study**

Source: Adapted from Google Maps.

# 5

# Evaluation of Recovery and Reconstruction

## Analysis of Influential Factors

A variety of factors, including support from policies, society as a whole, and China's national spirit, influenced the three-year-long postdisaster reconstruction and contributed to stable development in quake-hit areas.

**Support from policies**

Official policies were an important influence on postdisaster reconstruction. The research team collected and organized 127 relevant policy statements (see appendix for a partial listing). Thirty-seven documents were issued by the central government and dealt with large-scale planning principles, and 90 were issued by the Sichuan provincial government and addressed specific objectives and implementation issues.

The analysis of the policies showed that six principles applied to reconstruction both in urban and rural areas. These were people-oriented guidance, scientific planning, consideration of the needs of the collectives and government, self-reliance, state support, and social assistance. Analysis also suggested the importance of creative policies in reconstruction; the twin assistance mechanism was among the most significant, as well as those that emphasized the connection of rural reconstruction to new village construction.

A complete objective system for postdisaster reconstruction of infrastructure in rural areas can be inferred from the 11 relevant policies and documents (numbers 2, 4 – 6, and 12 – 18 in the appendix). The description of farmland appearing eight different times in the documents suggests the importance of farming in rural reconstruction.

**Support from the whole society**

Another influence on postdisaster reconstruction was the support given to those affected by the earthquake. People from all over China and from all walks of life offered sympathy and donated financial, physical, and spiritual assistance. This outpouring of support suggests the deep ties that unite the Chinese people.

Assistance was provided by a variety of funds, volunteers (including medical doctors and psychologists), celebrities, entrepreneurs, and companies with a strong sense of responsibility. Many foreign agencies also made large donations or provided other aid in response to the earthquake. The International Red Cross, international rescue teams, the United Nations, and others offered assistance to China. For example, Sichuan Province received ¥ 20.19 billion in donations, including ¥ 9.69 billion received by various provincial departments (Sichuan Charity Federation received ¥ 4.128 billion, Sichuan Red Cross ¥1.39 billion, Sichuan Financial Department ¥ 2.329 billion, and other departments ¥ 1.843 billion). Outside of Sichuan, donations amounted to ¥ 10.5 billion.

**Support from China's national spirit**

Another influence on postdisaster reconstruction was the Chinese people's spirit. The Chinese have experienced various hardships and disasters during their long history. It is such experiences that have built the Chinese people's resilience and helped them to recover after an event like the Wenchuan Earthquake.

## Evaluation of Development

By September 2011, the planning objectives articulated in Planning for Post-Wenchuan Earthquake Restoration and Reconstruction in Rural Areas had been completed.

After one year of reconstruction, 595 projects had been started in rural areas, accounting for 53.03 percent of all projects. Y 38.817 billion had been invested in the reconstruction, accounting for 46.14 percent of expected investment.

After two years, all 182 of the projects involving reconstruction of agricultural production facilities (farmland, planting, husbandry, and agricultural mechanical facilities), rural infrastructure (water-supply projects, biogas, and cleaning projects), and agricultural industry (plant bases, livestock and poultry, and aquatic products) had been started, as had work-relief projects and new construction for impoverished villages. The investment on these had reached Y 53.486 billion, or 99.79 percent of expected investment. All but a few projects completed the three-year objective in two years.

After three years, all reconstruction had been completed. The recovered and reconstructed rural production facilities and infrastructure surpass prequake levels.

Reconstruction of rural infrastructure not only meets present needs, it also lays a solid foundation for future development. Completing three-year objectives in two years allowed people to be settled relatively soon after the earthquake, and the rapid restoration of infrastructure and production and living facilities ensured people a more comfortable life.

## Evaluation of Quality

The Ministry of Housing and Urban-Rural Development issued several documents to clarify its requirement for the quality of postdisaster reconstruction projects. The provincial governments of Sichuan, Shaanxi, and Gansu issued Management for Qualities of Reconstruction Projects after the Wenchuan Earthquake. Governments at the village, city, county, and country level made specific rules for management of postdisaster reconstruction projects. In response, all implementation units took more detailed and strict measures to ensure the quality of projects.

**Quality objectives**

With the view that project quality is the lifeline of postdisaster reconstruction, all levels of government and all ministries supervised the reconstruction projects with strict requirements on construction procedures. Doing so guaranteed the projects' quality. Requirements were as follows:

(1) Seismic protection standards for both reconstruction projects and newly constructed buildings were increased; fortification intensity was raised from VI (6) degrees to VII (7) degrees.

(2) Buildings with high population densities (like schools, hospitals, shopping malls, and large public buildings), constructions with special functions, lifeline infrastructure (like electricity, broadcasting, post and telecommunications, roads and bridges, and transportation), and offices with emergency centers should be constructed with fortification of VIII (8) degrees.

(3) Rural houses should be built under strict quality standards and technical regulations.

**Quality management**

Quality management entailed the following:

(1) Enhancing the quality and assigning responsibility for safety and quality should be a top priority of reconstruction. All levels of governments, units engaging in the reconstruction, and agencies involved in supervising safety and quality should strive for safety and quality. If accidents occur, they should be accounted for by the relevant local officials as well as persons and units concerned.

(2) A lifelong system of project responsibility should be implemented based on relevant provisions of the state. Administrators responsible for the project, legal representatives, and units for surveying, designing, constructing, and supervising, as well as legal representatives of suppliers of equipment and materials, should all take lifelong responsibility for the work they carried out.

(3) Everyone involved in the construction work, at all levels, should strictly adhere to proper procedures for basic construction – from site selection, design, bidding, and project approval and beyond – to ensure that the quality of reconstruction meets national standards.

(4) Evaluation and appraisal of damaged houses should be carried out. An emergency response commission for damaged houses should organize relevant personnel to conduct a preliminary appraisal of damaged buildings and infrastructure, especially of public facilities supplying water, gas, electricity, and other lifeline systems. The construction units or project management units should require design units to design buildings that could be enhanced to withstand secondary disasters.

**Quality supervision**

The following are the requirements of quality supervision:

(1) All postdisaster reconstruction projects should follow official procedures outlined by the bidding system, project safety and quality supervision system, project supervision system, and contract management system. Projects should be supervised at all stages, from project demonstration, survey, and design to construction, and inspection.

(2) All levels of governments and construction executives should examine all designs and drawings. All designs should adhere to compulsory engineering construction standards and other related national regulations on quality and technology. Construction units are not allowed to modify drawings or lower quality standards, especially anti-earthquake standards, without being legally authorized.

(3) Constructing and supervising units should supervise the whole process of building, and make sure all parts of the project reach the relevant standards. All levels of quality-supervising agencies should strengthen the supervision of the safety work of parties involved in these projects. The newly built farm houses should be taken into the quality supervision system, and technical service should be carried out to help farmers build safe houses that meet quality standards.

(4) Cost should be strictly controlled. Optimized design and budget plans for construction costs are necessary for the parties involved in construction and for

relevant departments handling cost budgeting and management so that costs can be supervised. The goal is to control all construction costs and reduce investment required for the reconstruction as much as possible, while also guaranteeing quality and safety.

**Checking and acceptance of projects**

The following guidelines should guide checking and acceptance of projects:

(1) The acceptance of projects upon completion should follow procedures outlined in Construction Quality Management Regulations (issued by the State Council), Interim Procedures for Recording and Management of Completion Acceptance of Housing Construction and Municipal Infrastructure Construction, and Interim Procedures for Completion Acceptance of Housing Construction and Municipal Infrastructure Construction (both issued by the Ministry of Construction).

(2) All levels of government should list reconstruction projects as among the annual key construction projects and among those targeted for annual evaluation. Construction executives, construction units, project directors, engineering supervisors, and engineering technical personnel should be organized according to stages to do regular inspection and supervision at different levels, projects, and links. They should supervise all construction units and building units and help these units rectify problems in a timely fashion to make sure all projects proceed in accordance with quality standards, technical regulations, and management requirements.

(3) All construction administrative chiefs should be responsible for organizing, guiding, and supervising the implementation of reconstruction in their respective districts, making overall plans for construction, selecting sites, providing technical support, and organizing check and acceptance procedures. All relevant parties should further strengthen the organization of completion acceptance and procedures and standards for check and acceptance. Projects that failed to achieve national standards and standards of seismic protection should not be accepted, recorded, or delivered.

To ensure that senior management departments strengthen quality management, the Sichuan provincial government has issued specific regulations about quality management as well as the Quality Checklist of Postdisaster Reconstruction Projects in Sichuan Province, which provides basic information about the main responsibilities and relevant quality performance of all parties in construction, about implementation of compulsory engineering standards, and about safety risk in engineering quality.

## Evaluation of Funding

To make sure that funds are used rationally in reconstruction, and to prevent misuse of funds, use of funds for purposes unrelated to reconstruction, and bad debts for many years, all levels of government and all relevant departments have issued strict regulations about the use and management of funds.

The Sichuan government takes the following measures to ensure proper financial supervision:

(1) The provincial Department of Finance published Management Approach of Postdisaster Reconstruction Capital (Fund) in Sichuan Province (SCFO [2009] No. 13) to regulate collection and budgeting of funds; fund allocation and delivery; adjustment of category control numbers; application, delivery, and appropriation for fund budgeting; and supervision and management of use

of funds.

(2) The Sichuan Ministry of Finance has developed a system for managing fund information in postdisaster reconstruction that indexes basic information, construction conditions, fund arrangement, and implementation of all reconstruction projects for timely online supervision.

(3) According to the requirement of the provincial government, supervision of special funds should be carried out by the provincial Department of Finance, the provincial Development and Reform Commission, and the provincial Department of Audit in coordination with one another.

(4) One hundred officials from the provincial financial system have been assigned to work at quake-hit areas in order to supervise and build up a mutual system of supervision that includes the province, cities, and counties.

(5) The State Auditing Administration and the Sichuan Auditing Department have coordinated to conduct follow-up auditing of the use of funds in large reconstruction projects and to conduct auditing of returns for all reconstruction projects.

Notably, although postearthquake reconstruction meant that a large number of projects was undertaken and significant funds were used during a very short time period, there seems to have been no serious withholding of funds, and funds for reconstruction have generally stayed safe. This may be attributed at least in part to the protective measures in place, including strict regulations, powerful supervision, "sunshine" reconstruction measures, online supervision, on-spot supervision, and follow-up auditing.

The State Auditing Administration organized three follow-up audits for reconstruction projects. The first included 76 projects involving reconstruction of rural housing, schools, and infrastructure facilities for transportation, electricity, and telecommunications; the second included 72 key projects involving 753 schools and resident housing in 22 counties; and the third included 107 other key projects. All construction units have built sound financial management systems and use a regulated fund-management process, which has ensured that reconstruction funds are used for their specified purpose only.

## Evaluation of Safety

**General measures to ensure safe buildings**

The following general measures to ensure the construction of safe buildings – involving site selection, design, structure, and technical service – guided postearthquake reconstruction:

(1) Site selection. Village residents involved in site selection should be guided by experts to help them avoid the risk of further geological disasters. Relevant personnel should participate in the site selection and assist in planning to make sure that the decision is reasonable and scientifically sound.

(2) Design. Designs should fully consider antiseismic requirements to ensure houses' safety for village residents. Experts should be organized to give guidance to residents about house design, and personnel in research and designing units are encouraged to provide service to residents in towns and villages. Relevant departments should make general drawings suitable for houses both in towns and villages, and popularize the use of energy-and-earth-saving residences with high-safety features and antidisaster functions. Newly built houses in villages should be depart from traditional designs and adopt designs conforming to state standards.

(3) Structure. Designs for villages to be rebuilt should be provided as soon as possible to engineering and technical personnel in towns and villages, to construction workers, to families whose homes need rebuilding, and to management departments. Safety should be regarded as the key point of supervision, and problems with safety should be corrected promptly. There should be supervision of key links, including foundation trench work and work involving basic structure, body structure, prefabricated components, and temporary electricity, as well as setup and dismantling of scaffolding, elevated work, and formwork support. There should be quality control of needed materials like steel, cement, and bricks.

(4) Technical service. Technical service should be strengthened with multiple measures. One measure used after the Wenchuan Earthquake was to publicly distribute technical and training manuals written by experts for a popular audience.

**Scientific/technological measures to ensure safe buildings**

The following scientific/technological measures guided the postearthquake reconstruction process:

(1) Classifying damaged buildings. Scientific and objective evaluation should be the first step in the process of reconstruction. Reconstruction does not necessarily mean overturning all buildings and building new ones. The degree of damage, number of years the building was in use, and the cost of repair should be taken into consideration, and structural safety should be assured by means of repair, where possible, to avoid the waste from demolition. An initial classification of damaged buildings should clarify the appropriate action.

(2) Implementing new anti-earthquake protection standards and improving structural reliability. China's standards for seismic protection were compiled in 2001, before the Wenchuan Earthquake, but the destructive power of that earthquake exceeded the standard. For example, in Wenchuan, Chengdu, and Dujiangyan, the required fortification intensity was VII (7) degrees, and VIII (8) degrees to prevent collapse, but the actual intensity reached XI (11) degrees. According to seismic zoning in China at the time, the buildings could meet the requirement with fortification intensity of VII (7) or VIII (8) degrees if the required intensity in that zone was VI (6) or VII (7) degrees. The experience of an earthquake whose intensity was X (10) or XI (11) degrees forced improvement of the standard at a reasonable additional cost so that greater earthquakes could be withstood in the future.

(3) Selecting locations scientifically and conducting overall planning. The safety of building sites is the most important factor in reconstruction because of the immobility of buildings. As the first and key issue in the early stage of reconstruction, a long-term perspective is necessary: the sites should be located out of seismic fracture zones, landslide areas, river flood areas, and other areas at risk of geological disasters.

(4) Popularizing soft-resistance technology of seismic isolation and shock absorption.

Compared with the commonly used hard-resistance designs, soft-resistance technologies that rely on dynamic equilibrium represent a kind of reverse thinking: the principle is to cut off the transmission lines of destructive seismic shock. Specifically, this approach places a series of rubber and steel pads under the building to isolate the building from the floor. If an earthquake happens, the building slips on the rubber pad, the shock is isolated, and the bearing capacity is not affected.

(5) Focusing on detail structure. Correspon-ding measures governing detail structure should be followed in accordance with different structure components.

## Evaluation of the Cooperative Assistance Mechanism

Twin assistance is a typical Chinese experimental mechanism devised in response to the Wenchuan Earthquake. After the earthquake struck, the central government and unaffected provinces and cities acted quickly to provide various types of aid to the quake-hit areas. This spontaneous assistance pattern was soon formalized and systematized by the central government. Under the new regulation, 18 provinces and cites are paired with quake-hit areas in Sichuan; the twin provinces provide financial, technical, and other support.

The twin assistance mechanism has largely been successful and has helped move reconstruction and recovery forward. In Sichuan Province, for example, twin assistance has improved people's livelihoods. It has provided funding for housing in urban and rural areas, medical and health care, schools, roads and bridges, farmers' markets, water-supply and drainage facilities, municipal infrastructure, a welfare center, and cultural venues, most of which are expected to improve people's living condition and facilitate day-to-day living. Various roads, schools, and canals are named after the provinces and cities that provided assistance; these donor areas enjoy a high reputation among people in the quake-hit areas.

Twin assistance has also promoted economic and social development in Sichuan. The provinces and cities providing partnership assistance have emphasized both reconstruction and development, and they have helped these areas form rational industrial structures to support economic and social development. Among the approaches they have taken are building up industrial parks, implementing preferred investment projects, investigating enterprises, building platforms for product sales, providing assistance to those seeking employment, and educating and training officials. All these measures have helped to promote highly effective management and have enhanced the capacity for further development in quake-hit areas.

Finally, twin assistance has helped to enhance the image of the quake-hit areas of Sichuan. At all stages, twin assistance has adhered to a high standard to ensure the high quality of projects. Some of these projects have become the landmark buildings in these areas and have been highly commended by Sichuan and other provincial governments. In Sichuan twin assistance has both enabled the construction of buildings that embody the local flavor and national culture and allowed many villages to develop new industries such as tourism.

## Case Study

Based on the standards of hanging wall and footwall fault zones, on distance from fault zones, and on geomorphic features such as mountains, hills, and plains, nine villages from among those in Sichuan, Shaanxi, and Gansu were chosen for deep analysis. The analysis covers government guidance, principles of reconstruction, police assurance, organization patterns, fund collection, professional planning design, role of experts, social cooperation, villagers' participation, supervision from all walks of life, transparency of official village business, villagers' feelings about disaster relief, national harmony, cultural heritage, and subsequent development of the economy.

The case study analysis confirmed that the specific situation in the quake-hit villages should dictate the focus of reconstruction work. Reconstruction of production infrastructure in all rural areas is key, but development of tourism and agriculture should also be considered to solve the problem of long-term development in rural areas.

The case studies also showed that four factors greatly influenced infrastructure reconstruction. First, before the earthquake, many villagers had lived in mountainous areas with poor agricultural facilities. Second, village economic and agricultural levels were not advanced. Third, the production radius changed appreciably after reconstruction. Lastly, the existing infrastructure was weak.

To address these four factors, two measures were taken. First, planning of reconstruction made sure to incorporate infrastructure planning. Second, infrastructure was built to conform with the newly built villages and the standards of characteristic tourist development. Table 5.1 is an example of a schedule for infrastructure reconstruction, in this case in Yangliu Village in Taiping Xiang, Maoxian, Sichuan.

**Table 5.1 Sample Schedule for Infrastructure Reconstruction**

| Categories of projects | Size/number/number served |
|---|---|
| First period | |
| House/yard renovation; afforestation | 104 households |
| Tourist reception center (including parking lot) | 1,200 $m^2$ |
| Toilet facilities in tourist attractions | 1 (area of 40 $m^2$) |
| Pavilions | 10 |
| Garbage recycling stations | 2 |
| Signs | 200 |
| Folk culture center | 1 |
| Garbage cans | 150 |
| Public afforestation areas | 5,000 $m^2$ |
| Hydropower reform | 104 households |
| Toilets and sheds reform | 104 households |
| Street lamps | 20 |
| Sewage processing | 3 |
| Broadcasting | 100 households |
| Environmental improvement | 10 removed sheds and fences |
| Second period | |
| Eco-riverbank project | Overall |
| In-village roads | 290 m long, 6.5 m wide |
| Safety facilities for tourists | 1 clinic |
| Interhousehold roads and fences | Up to 1.8 km of roads (3 m wide), 6 km of fences |

Source: Maoxian Construction Bureau.

Note: Schedule is for Yangliu Village in Taiping Xiang, Maoxian, Sichuan. All projects listed have been entirely completed.

## Chapter Summary

Three main factors influenced the achievements in three years of reconstruction: policy support, social support, and national spirit. Among the principles guiding reconstruction planning were an orientation focused on people, a scientific approach, consideration of the needs of both the state and collectives, self-reliance, state support, and social support.

All objectives of rural reconstruction were completed on time, and living and producing facilities have been greatly improved. The rural production facilities and infrastructure recovered and reconstructed surpassed prequake levels. Governments and construction management departments took effective measures to ensure that the reconstruction process moved forward quickly and that quality, and safety standards were met.

The twin assistance mechanism, a creative form of Chinese postdisaster reconstruction funding and management, was largely successful.

# 6

# Evaluation of Project Impact

As described in chapter 4, the research team administered a survey to village officials and residents. Of the 482 questionnaires distributed, 384 were returned, for a response rate of almost 80 percent. The questionnaires provided significant original data; much of the information in this report was derived from the classification, cleaning, and computation of the data in the five survey categories.

The questionnaire analyzed key issues in two categories: first, village officials' opinions about and implementation of reconstruction relative to government reconstruction policies; and second, the degree of villagers' satisfaction with all aspects of reconstruction as well as their perception and recognition of the changes effected by reconstruction.

## Impact on Employment

Employment was a key issue addressed in the questionnaires. The following conclusions could be drawn about the effect of reconstruction on employment:

First, reconstruction funds were invested in the urgently needed projects concerning people's livelihood, village construction, and infrastructure; the projects were focused on primary and secondary industry (a smaller share involved tertiary industry) and could provide a lot of opportunities for employment. Second, labor-intensive industries like construction and manufacturing could provide some opportunities for migrant workers and workers in towns, but would not increase the rate of employment of college graduates. Third, the large sums invested in recovery speeded up the economic recovery, but were less successful in improving incomes and quality of employment. Finally, the large number of reconstruction projects could create jobs in the short term, but these jobs would end once reconstruction was complete.

The farmers in the quake-hit areas received skill training through participating in reconstruction projects, work relief, and industrial reconstruction. The major training opportunities came in the industries that funds were directed to. Table 6.1 lists those industries and amounts invested both before and after the mid-term adjustment.

The table shows fund usage clearly. First, most of the investment was spent on construction, which was considered the foundation for solving the problems of urban and rural housing as well as village construction in general. Second, with regard to the layout of production and industrial adjustment, before adjustment, overall investment of industrial planning reached Y 11.379972 billion, accounting for 75.448 percent of total investment; after adjustment, the investment was up to Y 12.646663 billion, accounting for 79.261 percent of total investment. Lastly, areas such as culture, employment, and social security (contained within the "other" category) as

**Table 6.1 Fund Allocation by Industry, before and after Mid-Term Adjustment**

| Industry | Total investment before adjustment (billion yuan) | Total investment after adjustment (billion yuan) | Percent change |
|---|---|---|---|
| Total for all industry | 885.83899 | 938.59676 | 6.00 |
| Housing construction in rural and urban areas | 248.52000 | 224.04155 | −9.80 |
| System construction in urban areas | 87.73400 | 93.51638 | 6.60 |
| Construction in rural areas | 70.11019 | 53.59583 | −23.60 |
| Construction of public service facilities | 97.41340 | 96.07314 | −1.40 |
| Infrastructure | 188.45972 | 269.35859 | 42.90 |
| Layout of production and industrial adjustment | 150.83051 | 159.55793 | 5.80 |
| Disaster prevention and reduction | 15.62820 | 15.70232 | 0.50 |
| Ecological restoration | 20.03524 | 20.59829 | 2.80 |
| Spiritual cultivation | 2.34140 | 1.37694 | −41.20 |
| Others | 4.76634 | 4.77579 | 0.20 |

Source: Mid-Term Adjustment in Post-Wenchuan Earthquake Reconstruction (Provincial Development and Reform Commission, 2009).

well as spiritual cultivation received relatively less investment – that is, less investment was used initially, and after adjustment, a small reduction was made. Investment in basic transportation facilities (contained in the "construction of public service facilities" category) was adjusted significantly upward.

Most of the investment was put into civil projects, like houses, infrastructure, and rural construction; this was true before and after adjustment. Public service facilities received 10.997 percent of the funds invested. The ratio of industrial investment was over 70 percent, while the investment in the financial service industry and culture industry was, respectively, ¥4.454444 billion and ¥2.88062 billion. After adjustment, they were reduced, respectively, by 28.5 percent and 24.8 percent.

Service industries like these could promote employment. Investment in tourism greatly increased after adjustment, from ¥4.944 billion to ¥7.58338 billion, an increase of 53.4 percent. Research from the World Tourism and Travel Board indicated that tourism in China provided employment opportunities directly and indirectly at a ratio of 3.6 to 1.0. Thus, tourism is an industry with a potentially significant employment effect that could alleviate employment pressure and promote sustainable economic development in Sichuan. Depending only on investment in and development of tourism, however, will not optimize the employment structure. Besides, some quake-hit areas had not developed tourism before the earthquake; some facilities are far from perfect and not entirely suitable for tourism.

The investment projects in Sichuan concentrated on labor-intensive industries like housing construction and infrastructure, which greatly increased the employment of farmers and low-skilled laborers. These projects absorbed farmers in a very short time but could not fundamentally solve the problem of employment in the long term. The industrial adjustment is likely to absorb skilled laborers and some farmers and laid-off workers in towns and cities in the long term. However, with the development of industrial technology, a squeezing effect will inevitably appear.

## Impact on Beneficiaries

This section describes the analysis of villagers' degree of satisfaction with various aspects of reconstruction. Sixty-one percent of villagers rated village planning as excellent or very good. In general, villagers were highly satisfied with reconstruction (see figures 6. 1 and 6. 2).

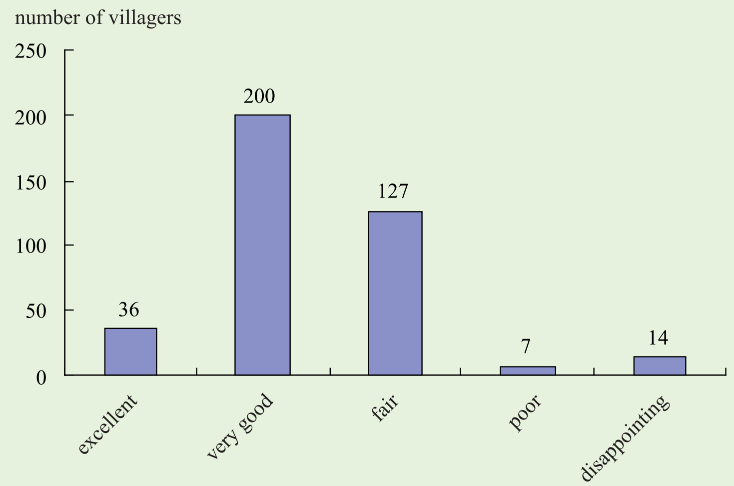


**Figure 6. 1 Villagers' Rating of Village Planning (numbers of villagers)**

Source: Adapted from questionnaires administered by authors.

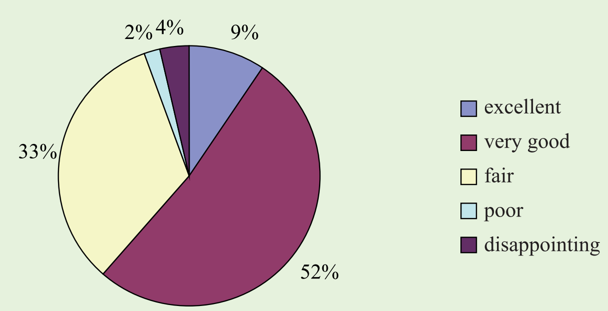


**Figure 6. 2 Villagers' Rating of Village Planning (percentages)**

Source: Adapted from questionnaires administered by authors.

Villagers' satisfaction with living and working conditions was also high.

Seventy-five percent of villagers called their living and working conditions obviously better than before the earthquake because of reconstruction (see figures 6. 3 and 6. 4).

Villagers were generally satisfied with reconstruction work; 68 percent called reconstruction work (including planning, organizing, leadership, and supervision) satisfactory (see figures 6. 5 and 6. 6). These results suggest that villagers were feeling confident about their future

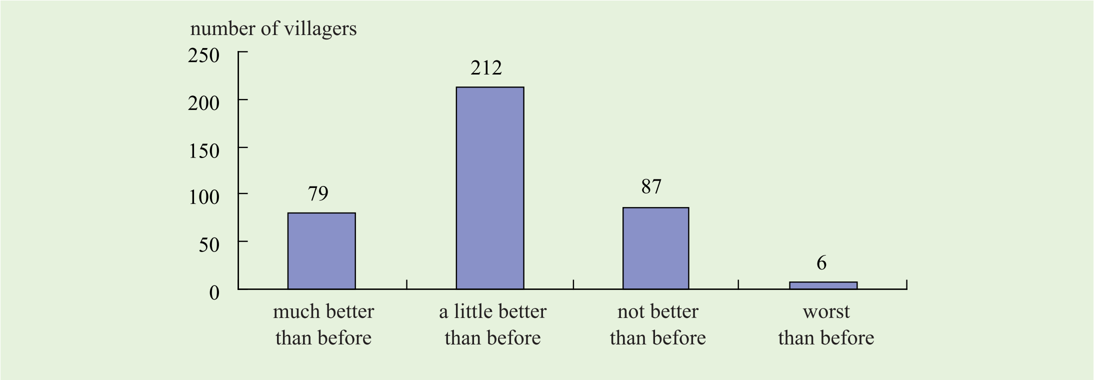


**Figure 6. 3 Villagers' Rating of Living and Working Conditions after Reconstruction (number of villagers)**

Source: Adapted from questionnaires administered by authors.

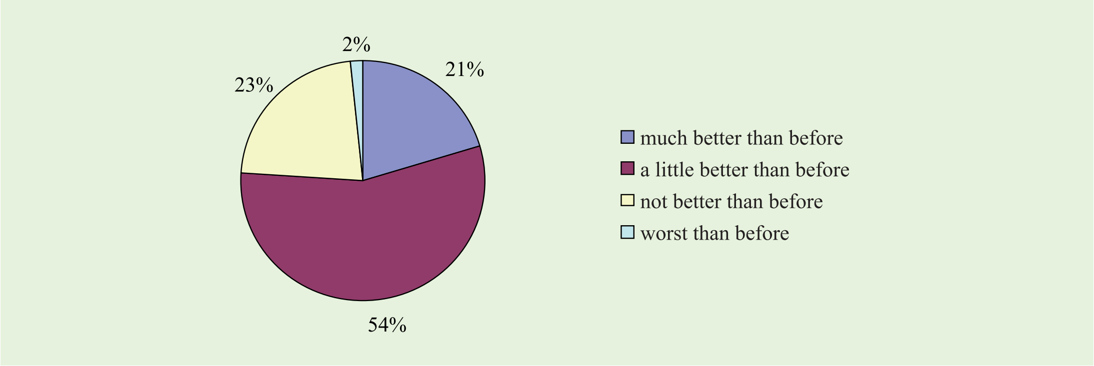


**Figure 6. 4 Villagers' Rating of Living and Working Conditions after Reconstruction (percentages)**

Source: Adapted from questionnaires administered by authors.

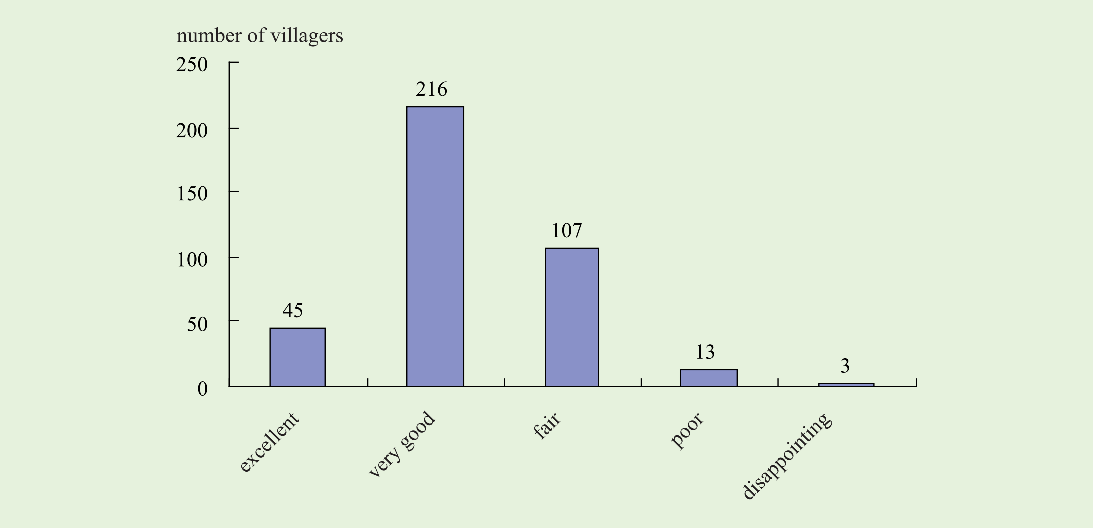


**Figure 6. 5 Villagers' Rating of Reconstruction Work (number of villagers)**

Source: Adapted from questionnaires administered by authors.

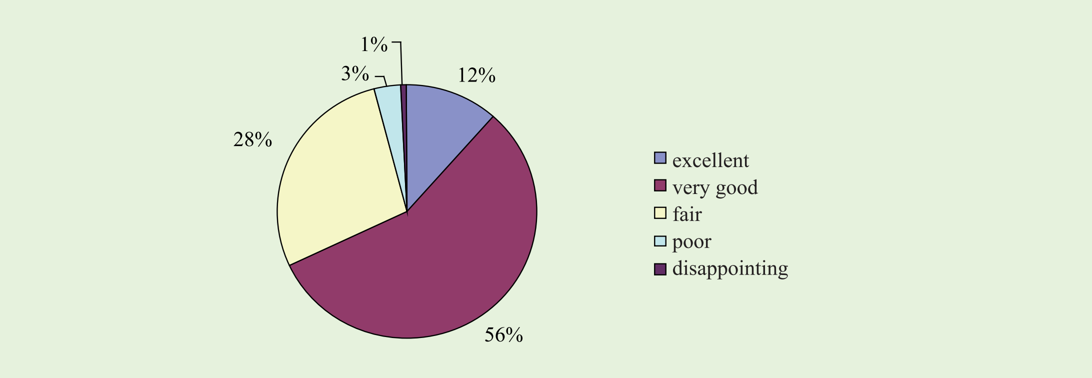


**Figure 6. 6  Villagers' Rating of Reconstruction Work ( percentages)**

Source: Adapted from questionnaires administered by authors.

The survey provided some information about the indebtedness of villagers in rural areas. It is important to recognize that the amount villagers could reasonably borrow was assessed by the local government so debts would not outweigh their ability to make repayments. The main creditor is the Rural Credit Cooperation Agency, a financial agency providing service for farmers and rural development; thus, it has offered favorable conditions for farmers. For those who still have difficulties in paying off the two-year interest-free loan, the government will negotiate with financial agencies to postpone repayment.

## Impact on New Rural Construction

The questionnaires for both officials and villagers provide information about the relationship between new rural construction and reconstruction ( see figures 6. 7 and 6. 8). Generally, reconstruction in quake-hit areas speeded up new rural construction, with the rebuilt villages serving as an example for the new rural construction.

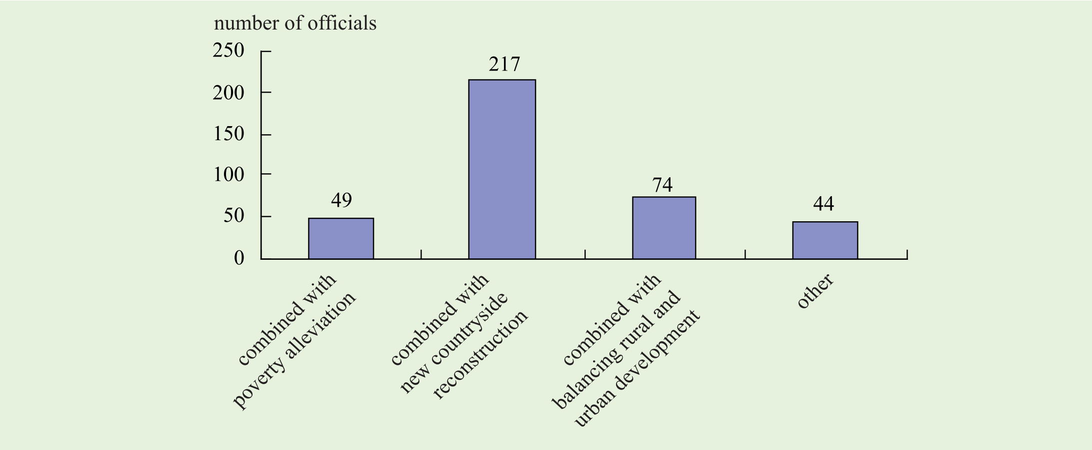


**Figure 6. 7  Officials' View of Influence of Postdisaster Reconstruction ( number of officials)**

Source: Adapted from questionnaires administered by authors.

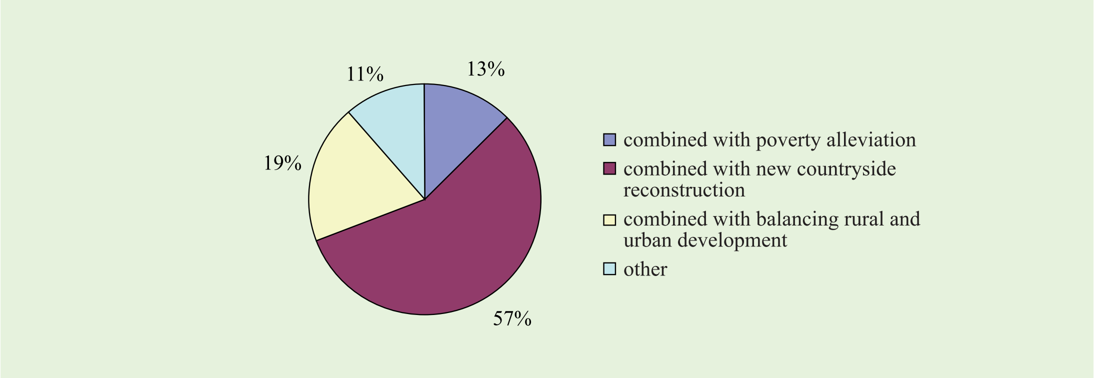


**Figure 6. 8 Officials' View of Influence of Postdisaster Reconstruction (percentages)**

Source: Adapted from questionnaires administered by authors.

## Impact on Management of Democracy

In 2006, the central government articulated the goals of new rural construction: development, affluence, rural progress, an attractive appearance for villages, and democratic management.

Questionnaires show that 54 percent of officials prefer that decision making on key issues take place at the village collective meeting. This response suggests that in the process of reconstruction, grassroots decision making has emphasized the involvement of all villagers and has strengthened democratic management (see figures 6. 9 and 6. 10).

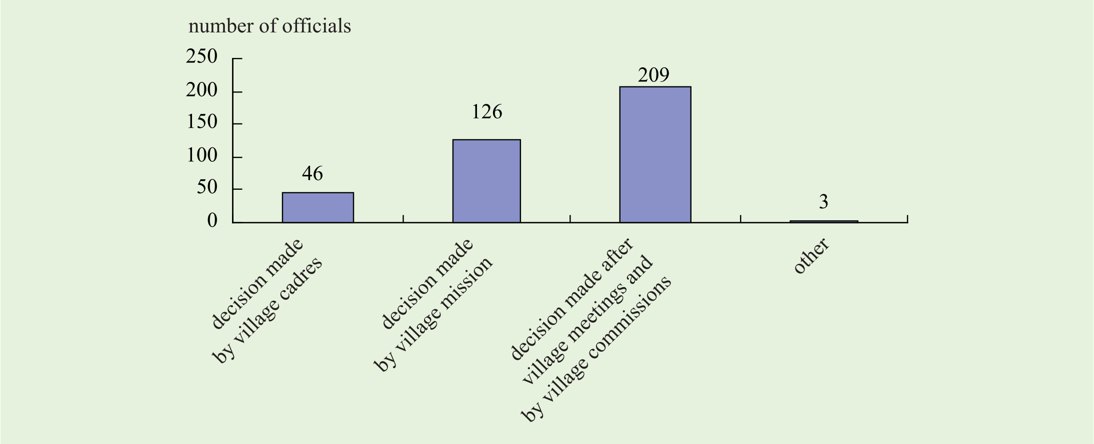


**Figure 6. 9 Officials' Preferred Method for Making Decisions about Rural Reconstruction Issues (number of officials)**

Source: Adapted from questionnaires administered by authors.

## Impact on Public Ability to Respond to Natural Disasters

According to the second questionnaire, 62 percent of villagers accepted formal business training, 68 percent of villagers accepted formal training in disaster prevention and reduction, and 74 percent of households received technical support for farmhouse rebuilding (see figures 6. 11, 6. 12, and 6. 13). These statistics suggest that villagers' ability to respond to natural disasters has been increased.

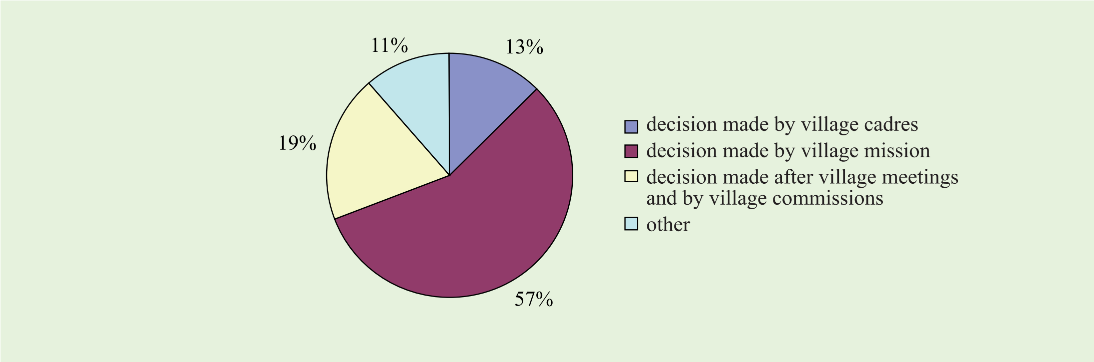


**Figure 6. 10 Officials' Preferred Method for Making Decisions about Rural Reconstruction Issues (percentages)**

Source: Adapted from questionnaires administered by authors.

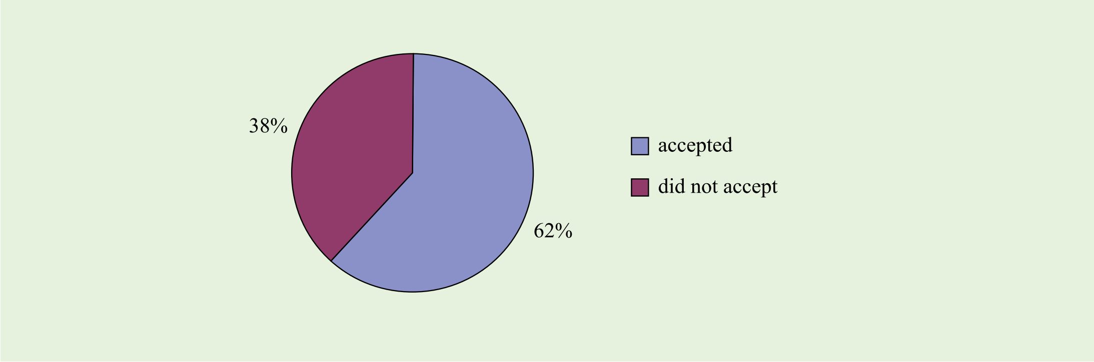


**Figure 6. 11 Villagers' Acceptance of Formal Business Training**

Source: Adapted from questionnaires administered by authors.

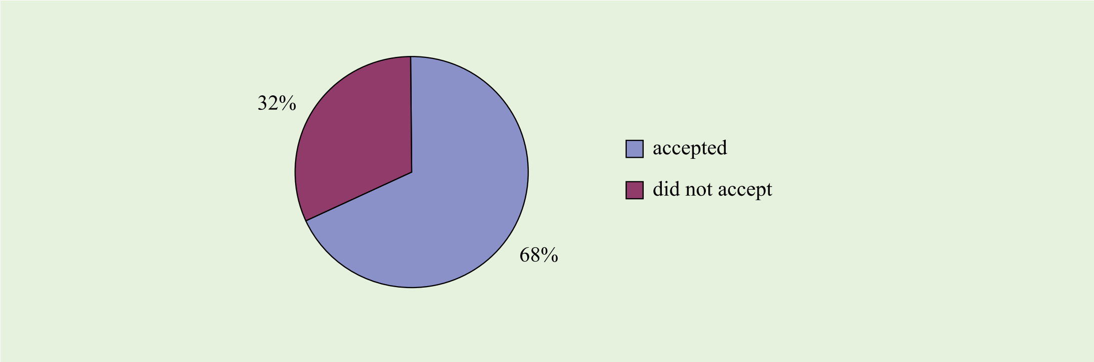


**Figure 6. 12 Villagers' Acceptance of Formal Training in Disaster Prevention and Reduction**

Source: Adapted from questionnaires administered by authors.

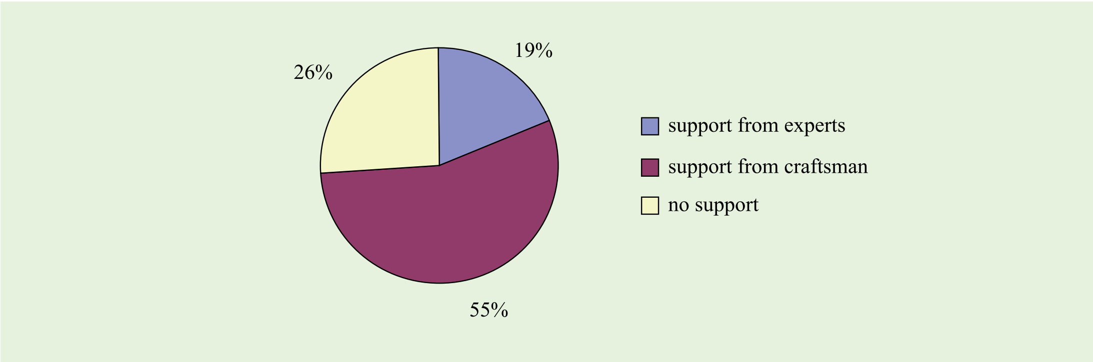


**Figure 6. 13 Technical Support for Farmhouse Rebuilding Received by Villagers**

Source: Adapted from questionnaires administered by authors.

## Chapter Summary

Rural reconstruction has increased employment in secondary industry, especially in construction, in the short term, but these increases will not be stable over the long term.

Survey analysis shows that most villagers (about 70 percent) rate as satisfactory reconstruction planning, reconstruction work, and living and working conditions following reconstruction.

Survey responses from village officials suggest that in general, reconstruction could promote the process of new rural construction, especially in promoting the level of village democratic management.

Reconstruction could improve villages' disaster prevention and reduction capabilities in a general way.

# 7

# Conclusion

## Experience and Lessons

The central government's priority in reconstruction after the Wenchuan Earthquake was people's livelihoods and interests; the government also sought to promote the establishment of a harmonious society that would serve as a solid foundation for the ongoing postdisaster reconstruction.

It is clear from the government's quick and appropriate response to villagers' need that rural reconstruction, especially reconstruction of rural housing, was always a key emphasis of overall planning. This emphasis on rebuilding villagers' housing enabled China to address the housing needs of a huge number of affected people (as many as 11.4708 million from 3.476 million households); to support them in their efforts to rescue themselves; and to complete reconstruction even as the whole world was experiencing an economic crisis. The outcome of reconstruction is that economic and social development, as well as living and working conditions, have been improved over what they were prior to the disaster.

The integration of government support and market mechanisms for funding provides an example of how to solve the reconstruction funding problem for disadvantaged minorities. Farmers have always been among the poorest groups in China for historical reasons, and the farmers in western China are the very poorest. Before the earthquake, financing for reconstruction in rural areas was a difficult problem but it has now been solved.

In Sichuan, for example, when some of those affected by the earthquake could not afford to rebuild their houses, the provincial government took two steps. First, it carried out allowance policies to provide direct money assistance. Second, it allotted Y 4 billion to help governments in quake-hit counties and cities offer creative financial arrangements – guarantee funds and funds with interest deductions as well as housing loans guaranteed by the government with three-year interest deduction. The disadvantaged western farmers overcame their difficulties with the help of government's allowance, guarantees, and interest deductions, along with loans from financial agencies.

Another achievement of note to come out of reconstruction has been the establishment and promoting of construction technology standards for farmhouses to guarantee their safety. *Antiseismic Design Guidance for Rural Residence Buildings*, an internal government document, specifies antiseismic design for rural residence buildings and ends a thousand-year-long history of rural residences constructed without any antiseismic features. Another internal government document, *Construction Technology Guidance for Rural Residence Buildings in Postdisaster Reconstruction*, provides effective technical support to farmers building their own houses. These technologies are of historical significance for the improvement of antidisaster and disaster-relief capacity in rural areas.

It is also now apparent that rural reconstruction was beneficial to both new rural construction and sustainable development. In the planning of rural reconstruction, one of three different approaches – reconstruction on the original site, reconstruction in the original location but on a different site, and reconstruction in a different location – was chosen based on the degree of damage, constructional condition, and ecological environment. This method realizes reconstruction of the village system by combining village planning with layout of rural production and optimized layout of rural residences, imposing a more rational and useful arrangement in rural areas. The method not only accords with the requirement of rationalizing rural layout and optimizing rural appearance, but also lays a solid foundation for sustainable development in rural areas – the goal of which is to build a new countryside with developed production, a high living standard, an attractive appearance, and democratic management.

Two final points bear stating. First, the rural housing reconstruction process managed to respect people's preferences and autonomy while avoiding the contradictions that could arise from many individuals making varying demands. The construction management department provided multiple choices of house structure and room layout for villagers; it also relied on the independent decision-making procedure of the villagers' commission to cope with varying individual demands, which proved a great help in fostering an efficient reconstruction process. Second, rural reconstruction kept in mind the principle of "creating local flavor and inheriting national culture," and as a result fostered national unity as well as developing the local economy.

## Remaining Issues

Three significant issues arising out of rural reconstruction remain unresolved. First, it is not clear whether the productivity of resettled villagers will recover in the long term. Second, it is not clear how to help poor villagers recover their productive capacity to ensure they can repay reconstruction loans. Third, there is still a risk of secondary disaster in the Longmen fault zone, which poses a threat to postdisaster reconstruction and follow-up development. A detailed emergency-response mechanism would be desirable for the area.

# Appendix:

## Main Policy Documents Influencing Postdisaster Reconstruction

1. Emergency Notice from Ministry of Finance on Partial Assistance to Areas Affected by the Wenchuan Earthquake.

2. Ministry of Civil Affairs, Ministry of Finance, and Ministry of Housing and Rural Construction Guidance on Post-Wenchuan Earthquake Reconstruction of Collapsed Houses in Rural Areas (CQ [2008] No. 136).

3. Ministry of Construction Notice on Supervision of Post-Wenchuan Earthquake Partial Assistance (SCMC [2008] No. 69).

4. Ministry of Finance and the National Development and Reform Commission Notice on Reduction of Administrative Fees in Areas Severely Affected by the Wenchuan Earthquake (MF [2008] No. 50).

5. Ministry of Finance Notice on Partial Reduction of Governmental Fund in Areas Severely Affected by the Wenchuan Earthquake (MF [2008] No. 49).

6. Ministry of Housing and Rural Construction Notice on Post-Wenchuan Earthquake Security of Housing Projects (CQ [2008] No. 146).

7. Ministry of Human Resources and Social Security Notice on Employment Support in Quake-Hit Areas (MHRSS [2008] No. 8).

8. Ministry of Human Resources and Social Security Notice on Further Implementation of Employment Assistance in Quake-Hit Areas (MHRSS [2008] No. 12).

9. Ministry of Human Resources and Social Security Notice on Relative Policies on Partial Assistance in Post-Wenchuan Earthquake Reconstruction (MHRSS [2008] No. 64).

10. Ministry of Human Resources and Social Security Notice on Talent Support for Reconstruction in Quake-Hit Areas (MHRSS [2008] No. 11).

11. Ministry of Human Resources and Social Security Notice on Technique Training Assistance in Quake-Hit Areas (MHRSS [2008] No. 7).

12. Ministry of Land and Resources Notice on Security of Special Support for Post-Wenchuan Earthquake Reconstruction (MLR [2008] No. 119).

13. Regulation of Post-Wenchuan Earthquake Reconstruction and Restoration ([2008] State Council No. 526).

14. Sichuan Provincial Government Instructions on Support for Post-Wenchuan Earthquake Reconstruction Measures (SC [2008] No. 20).

15. Sichuan Provincial Government Notice on Post-Wenchuan Earthquake Repair of Damaged Houses in Villages (SC [2008] No. 124).

16. Sichuan Provincial Government Notice on Post-Wenchuan Earthquake Residential Reconstruction in Rural Areas (SC [2008] No. 96).

17. State Council Instructions on Support for Post-Wenchuan Earthquake Reconstruction Measures (GF [2008] No. 21).

18. State Council Notice on Publishing Overall Plan for Post-Wenchuan Earthquake Restoration and Reconstruction (GF [2008] No. 31).

# PART THREE

## Evaluation of Wenchuan Earthquake Postdisaster Reconstruction Efforts:
## Investigative Report on Reconstruction of Urban and Rural Housing

# Introduction

In May 2008, a severe earthquake occurred in Wenchuan, China. Its effects were felt in Sichuan, Gansu, Shaanxi, Chongqing, Yunnan, and 10 other provinces, districts, and municipalities – that is, over a total area of about 500,000 $km^2$. The magnitude reached 8.0 on the Richter scale, and the maximum intensity reached XI (11) degrees. The earthquake caused an enormous number of casualties and extensive damage to rural and urban housing and to rural infrastructure. Immediately after the earthquake, the Chinese government began to organize and conduct a rapid response to the disaster. It also began to prepare for postdisaster reconstruction work.

Since then, the postdisaster recovery and reconstruction work has made great strides and has achieved remarkable results. The Chinese government has undertaken an in-depth study of the restoration and reconstruction process to sum up achievements and experiences thus far. The study will make it possible to compare the Chinese experience of recovery and reconstruction after major disasters with that of other countries, and to offer lessons for other countries to draw on.

This report focuses on rural and urban housing reconstruction in Sichuan, Gansu, and Shaanxi. All the first-hand information and data were collected from statistical socioeconomic sources, from the State Council's Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction, and through field visits and interviews with government agencies and stakeholders from provinces, cities, and districts in the worst-hit areas. The report establishes a framework for evaluating rural and urban housing reconstruction to facilitate the summing up of lessons and achievements.

The report first describes and analyzes predisaster conditions in affected areas, including the socioeconomic situation, availability and consideration of hazard risk maps in land use planning, and rural and urban housing conditions, as well as the status of technical construction standards and implementation of building codes for rural and urban housing.

The report then analyzes the main impacts of the earthquake, and it concludes that the damage to housing in quake-hit areas was very serious and reconstruction very difficult. It also analyzes the earthquake's impact on society, the economy, and the environment. The analysis finds that the earthquake had only a slight influence on China's economy as a whole because Sichuan – the hardest-hit province – makes up a small share of the national economy.

The third chapter describes the key objectives of rural and urban residential reconstruction and explains project classification, scale, investment levels, and progress. It then describes the policy security mechanism, including funding methods, progress control, quality supervision, risk control, and safety management.

The fourth chapter explains the main housing reconstruction indicators and describes data resources and the evaluation methodology (qualitative and quantitative).

The fifth chapter evaluates the relevance, efficiency, and effectiveness of reconstruction implementation by comparing actual results with the plan objectives. The comparison specifically addresses program progress, quality guarantees, safety management, program cooperation, and risk control. Case studies are also described in this chapter.

The sixth chapter evaluates program impacts. It looks specifically at the impacts of reconstruction on socioeconomic development and urban and rural residents' living standards; it also investigates the connection of housing reconstruction to changes in disaster prevention and reduction abilities, to urbanization, and to urban-rural coordination.

The final chapter summarizes the research findings and offers lessons for future reconstruction in the wake of disaster.

# 1

# Predisaster Conditions

## Socioeconomic Conditions Prior to Disaster

The Wenchuan Earthquake affected Sichuan, Gansu, Shaanxi, Chongqing, Yunnan, and 10 other provinces (including 417 prefectures), with a total area of about 500,000 $km^2$. The worst-hit areas amounted to 132,596 $km^2$ and included parts of Sichuan, Gansu, and Shaanxi (including 51 cities and prefectures in total). By the end of 2007, before the earthquake, the affected area had a total population of 19,867,000, with a gross domestic product (GDP) of Y 241.8 million; the per capita disposable income reached Y13,050 for urban residents, and Y 3,533 for rural residents.

The worst-hit area is located at the transition belt between the Sichuan Basin and the Qinghai-Tibet Plateau, with the Longmen Mountains as its border. The different geological and geomorphological conditions of the western and eastern regions have produced a socioeconomic development gap. The features of the area include the following:

- Complicated geological conditions. The quake-hit area is scattered with plains, hills, plateaus, and mountains. Part of it belongs to the alpine and gorge region.
- Frequent natural disasters. With fracture zones scattered in the mountains, the area experiences frequent earthquakes and other geological disasters such as landslides.
- Vulnerable ecological environment. The area of plateaus and mountain has such problems as poor farmland, infertile soil, and serious water and soil erosion.
- Diverse ecological system. The area is home to a variety of plants and wildlife resources including rare and endangered wildlife. It acts as an important ecological barrier for the upper reaches of the Yangtze River.
- Natural and other resources. The area's natural resources include nonferrous metals and nonmetallic minerals. The area also contains world cultural and natural heritage sites,
- Presence of ethnic minorities. Different cultures coexist in the area. It is the main habitation of the Zang minority and the only area inhabited by Qiang minority.

## Land Conditions Prior to Disaster

According to statistics on land use in 2007, the total size of the land in affected areas (made up of 51 counties) is 13.2425 million hectares, of which 12.0159 million hectares (90.7 percent of the overall area) are agricultural land. Land for construction takes up 435,400 hectares, or 33 percent of the overall area; unused land takes up 791,200 hectares, or 6 percent of the total area.

The majority (55.6 percent) of agricultural land is woodland; pasture makes up another 14.2 percent, and arable land 14.1 percent. (The rest of the land is not classified). Land suitable for construction is mainly for rural residences, with 65.8 percent of land for construction devoted to housing.

Woodland and pasture are the main land types in the northwestern plateau and mountain areas, while the arable land is mainly located in the southeastern plain areas, hilly areas, and valley areas. Urban and rural residences are centralized in the plain and valley areas.

The geographical conditions across the area are very complicated, with many factors affecting and limiting the land use, which leads to high-cost reconstruction and a shortage of back-up land resources.

## Urban and Rural Housing Conditions Prior to Disaster

According to data for 2007, the total area of urban and rural housing amounted to 3.02 billion $m^2$ (building area), with urban housing accounting for 580.66 million $m^2$ and rural housing for 2.4433 billion $m^2$. Some details about urban and rural housing in affected areas are given in tables 1.1, 1.2, and 1.3.

**Table 1.1 Rural Housing Conditions in Sichuan, Shaanxi, and Gansu, 2006**

| | Size ($m^2$/person) | Value of housing (yuan/$m^2$) | Housing structure ($m^2$/person) | |
|---|---|---|---|---|
| | | | Reinforced concrete | Brick-and-timber structure |
| Sichuan | 34.67 | 189.76 | 10.17 | 17.12 |
| Shaanxi | 26.93 | 223.20 | 9.66 | 11.31 |
| Gansu | 19.12 | 183.97 | 1.08 | 6.56 |

Source: Adapted from China Statistical Yearbook 2007 (Beijing: China Statistics Press, 2007).

**Table 1.2 Rural Housing Conditions, 1990–2006**

| | 1990 | 1995 | 2000 | 2005 | 2006 |
|---|---|---|---|---|---|
| Newly built housing | | | | | |
| Size ($m^2$/person) | 0.82 | 0.78 | 0.87 | 0.83 | 0.84 |
| Value (yuan/$m^2$) | 92.32 | 200.30 | 260.23 | 373.31 | 392.93 |
| Size by structure ($m^2$/person) | | | | | |
| Reinforced concrete | 0.23 | 0.33 | 0.47 | 0.51 | 0.54 |
| Brick-and-timber structure | 0.47 | 0.37 | 0.36 | 0.29 | 0.27 |
| Conditions at year-end (all rural housing) | | | | | |
| Size ($m^2$/person) | 17.83 | 21.01 | 24.82 | 29.68 | 30.65 |
| Value (yuan/$m^2$) | 44.60 | 101.64 | 187.41 | 267.76 | 287.76 |
| Size by structure ($m^2$/person) | | | | | |
| Reinforced concrete | 1.22 | 3.10 | 6.15 | 11.17 | 11.79 |
| Brick-and-timber structure | 9.84 | 11.91 | 13.61 | 14.12 | 14.59 |

Source: Adapted from China Statistical Yearbook 2007 (Beijing: China Statistics Press, 2007).

**Table 1.3** **Size of Newly Built Urban and Rural Housing, 1996 – 2006**

| Year | Total area of newly built urban housing (100 million $m^2$) | Total area of newly built rural housing (100 million $m^2$) | Housing size per person, urban ($m^2$) | Housing size per person, rural ($m^2$) |
|---|---|---|---|---|
| 1996 | 3.95 | 8.28 | 17.0 | 21.7 |
| 1997 | 4.06 | 8.06 | 17.8 | 22.5 |
| 1998 | 4.76 | 8.00 | 18.7 | 23.3 |
| 1999 | 5.59 | 8.34 | 19.4 | 24.2 |
| 2000 | 5.49 | 7.97 | 20.3 | 24.8 |
| 2001 | 5.75 | 7.29 | 20.8 | 25.7 |
| 2002 | 5.98 | 7.42 | 22.8 | 26.5 |
| 2003 | 5.50 | 7.52 | 23.7 | 27.2 |
| 2004 | 5.69 | 6.80 | 25.0 | 27.9 |
| 2005 | 6.61 | 6.67 | 26.1 | 29.7 |
| 2006 | 6.30 | 6.84 | – | 30.7 |

Source: Adapted from China Statistical Yearbook 2007 (Beijing: China Statistics Press, 2007).
Note: – = not available.

## Building Codes and Technical Standards Prior to Disaster

The Implementation of Building Safety in Rural Housing, issued by the State Seismologic Bureau in 2007, explicitly stipulated that the seismic fortification intensity should reach VI (6) degrees in rural areas, equal to the basic requirement to be implemented in other areas by 2020. This requirement suggested a fresh start for the implementation of seismic design in rural housing. Before it was issued, the lack of standardized management, as well as the lack of awareness of scientific construction, meant that most rural housing was built without planning, design, or quality supervision.

The Code for Seismic Design of Buildings (GB50011 – 2001) issued in 2001 was implemented in urban housing construction in areas at risk of earthquakes. The 2001 code addressed seismic design of steel structure buildings, seismic isolation, and seismic-energy dissipating designs. In order to reflect the latest outcomes of earthquake geological research in China and conform to international standards, a new version of the Seismic Ground Motion Parameter Zonation Map of China (GB18306 – 2001) was also issued in 2001. Since the 1980s, urban and rural building construction has expanded quickly, with extensive use of new materials and new technology. In the mean time, earthquake disasters both at home and abroad have provided not only new experiences, but also new problems.

In urban areas, building codes and building technical standards have generally been implemented very well. After the issuing of new codes, all parties involved in construction as well as technical staff responsible for project quality supervision are required to be familiar with the codes. The Supervision of Compulsory Implementation of Engineering Construction Standards, document no. 81 issued by the Ministry of Housing and Urban-Rural Development, explicitly stipulates that all relevant departments of construction should be trained and tested in the codes. Personnel who fail the test will be relocated to other positions. Design companies that fail to train their staff will be warned and required to take measures to ensure that the codes are learned. Technical staff who fail to learn and do not pass assessments will not be allowed to participate in design and review.

The Ministry of Housing and Urban-Rural Development has put in place a construction drawing design and review system. The review procedure constitutes an effective way to check that codes are being implemented. After the official implementation of the codes, the system calls for the drawing review to be done in accordance with the standards. Any action violating the standards is strictly forbidden.

According to two sets of guidelines – the Provisions of Quality Management of Construction Projects and the Supervision of Compulsory Implementation of Engineering Construction Standards – the local administrative departments of construction are to supervise the codes' implementation.

## Summary

This chapter described predisaster conditions, including predisaster socioeconomic development, land conditions in rural and urban areas, and urban and rural housing conditions, as well as implementation of building codes and technical standards for urban and rural housing.

Prior to the Wenchuan Earthquake, the 2001 codes were executed well in housing construction in urban areas at high risk of earthquakes. In rural housing construction, however, codes were not implemented and management was not standardized.

# 2

# Main Impacts of the Earthquake

## Damage to Urban and Rural Housing

The Wenchuan Earthquake caused extensive damage to rural and urban housing in three provinces, Sichuan, Gansu, and Shaanxi. There were 5.13 million households in total whose houses were damaged in the earthquake in the reconstruction planning areas. There were 2.91 million households whose houses collapsed and were entirely destroyed. Table 2.1 shows the damage to rural and urban housing in the hardest-hit areas areas.

**Urban housing**

There was a total of 100.1 million m$^2$ of urban housing damaged in the earthquake, with 14.57 million m$^2$ collapsed, 48.71 million m$^2$ severely damaged, and 47.13 million m$^2$ less severely damaged; 1.26 million households were affected, 720,000 of which suffered from housing collapse and serious damages.

**Rural housing**

A total of 15.74 million rooms of rural housing was damaged in the earthquake, with 4.88 million collapsed, 4.16 million severely damaged, and 6.69 million less severely damaged; 3.87 million households were affected, 2.19 million of which suffered from housing collapse and serious damages.

**Quake-hit areas in Sichuan**

Sichuan suffered tremendous damage to urban and rural housing. By June 30, 2008, 647.99 million m$^2$ of urban and rural housing in the province had been damaged, directly affecting a total population of 1.812 million. The total area of damaged urban housing amounted to 226.2 million m$^2$, with 19.33 million m$^2$ of housing collapsed and 6.876 million m$^2$ severely damaged. Damage to urban housing directly affected 6.65 million residents (2.11 million households), and economic losses amounted to ¥146.4 billion. The total area of damaged rural housing amounted to 421.79 million m$^2$. The damage directly affected 11.47 million residents in 3.47 million households, and economic losses amounted to ¥1.9 trillion.

## Impacts on Socioeconomic and Natural Environment

**Analysis of social impacts**

The Wenchuan Earthquake has served as a test of the government's executive ability and of the mechanisms for responding to major disasters. Only two hours after the earthquake, President Hu Jingtao convened an emergency meeting. Prime Minister Wen Jiabao reached the quake-hit area in five hours in order to be present as the rescue work went forward. The People's Liberation

**Table 2.1** **Damage to Urban and Rural Housing in Worst-Hit Areas**

| | All housing | | Urban housing | | | | | | Rural housing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Households (million) | | Size (100 million $m^2$) | | | | Households (million) | | Rooms (million) | | | | Households (million) | |
| | Total | Collapsed and severely damage | Total | Collapsed | Severely damaged | Mildly damaged | Total | Collapsed and severely damaged | Total | Collapsed | Severely damaged | Mildly damaged | Total | Collapsed and severely damaged |
| Three provinces | 5.1279 | 2.9090 | 110.4051 | 14.5663 | 48.7089 | 47.1299 | 1.2556 | 72.03 | 15.7416 | 4.8814 | 4.1657 | 6.6945 | 3.8723 | 2.1887 |
| Sichuan | 4.5356 | 2.5988 | 106.2127 | 13.9668 | 47.8757 | 44.3703 | 1.1801 | 68.71 | 13.4219 | 3.9969 | 3.6499 | 5.7750 | 3.3555 | 1.9117 |
| Gansu | 0.4100 | 0.2583 | 3.3533 | 0.5821 | 0.5706 | 2.2006 | 0.0615 | 2.85 | 1.8209 | 0.8512 | 0.4094 | 0.5603 | 0.3485 | 0.2298 |
| Shaanxi | 0.1822 | 0.0519 | 0.8391 | 0.0175 | 0.2626 | 0.5590 | 0.0140 | 0.47 | 0.4988 | 0.0333 | 0.1064 | 0.3592 | 0.1683 | 0.0472 |

Source: Adapted from Ministry of Civil Affairs data.

Army and People's Armed Police quickly began the rescue, followed by the public security force, firefighters, medical staff, and professional earthquake search and rescue teams. During the rescue, all available information was published regularly by the press. The accuracy, authoritativeness, transparency, and timeliness of the information helped to maintain social order and trust in the rescue process.

**Analysis of impacts on natural environment**

*Vegetation, animals, and topography*

The Wenchuan Earthquake hit areas of considerable biodiversity and ecological sensitivity. The earthquake had significant impacts on the region's vegetation, rare animals, and topography. Ecological recovery will take a very long time. Moreover, the stratum structure of quake-hit areas is mainly composed of gneiss and phyllite, whose loose structure can easily lead to land collapse in heavy rain. Damage to the vegetation caused a decrease in water and soil conservation. With the high rainfall in the south, the possibility of landslides is increased.

*Living and production environment*

The possibility of pollution increased in the wake of the earthquake for two reasons: the concentrated resettlement of the victims, and damage to chemical enterprises in the quake-hit area. Concentrated resettlement poses a problem because of the waste produced; with some sewage treatment plants shut down following the earthquake, daily household waste and medical waste cannot be disposed of promptly, and the result is potential pollution of soil, rivers, and lakes and the spread of disease. Damaged chemical enterprises pose a problem because chemical leaks may cause fire, explosion, or the diffusion of poisonous chemical, which can in turn lead to pollution of soil, rivers, reservoirs, groundwater, and the atmosphere.

*Natural landscape and cultural heritage*

Complicated topography and climate diversity characterize the special natural landscape of Sichuan. The province is home to 21 grade 4A and 3A tourist areas, among them two world natural heritage sites (Jiuzhai Valley and Huanglong), one world cultural heritage site (Dujiangyan Irrigation Project and Qingcheng Mountain), and one world cultural and natural heritage site (Mount Emei and Leshan Giant Buddha, which is not located in the fracture zone). Table 2.2 provides some details of the damage to both the natural landscape and cultural heritage sites.

**Table 2.2 Earthquake's Effect on Natural Landscape and Historic and Cultural Heritage Sites in Sichuan**

| Classification | | Details |
|---|---|---|
| Natural landscape | Forest | 456 spots (mainly 3A scenic spots) damaged |
| | World natural heritage | Jiuzhai Valley and Huanglong not damaged |
| Historic and cultural heritage sites | World cultural heritage | In Dujiangyan: Double King Temple, Crawling Dragon Temple, and part of ancient buildings of Mount Qingchen damaged severely |
| | Cultural relics | Total of 1,839 pieces damaged, including 151 valuable historic relics |

Source: Adapted from Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction (State Council, 2008).

**Evaluation of economic impacts**

Although the earthquake had a slight impact on macroeconomic trends in China, it caused massive damage to the regional economy in affected areas.

## Summary

The earthquake did not have a significant impact on air and water quality in affected areas, which facilitated the task of reconstruction. In all other respects reconstruction confronted difficulties: the earthquake caused very serious damage to housing in affected areas; the damage to forests and wildlife habitats led to frequent secondary disasters; and there was damage to both cultural and natural heritage sites. Damage to the infrastructure of industries affected the structural adjustment of related industries, which directly hindered economic development in Sichuan. However, the earthquake had only a slight influence nationwide because Sichuan makes up a small share of the national economy. Employment was significantly affected in quake-hit areas, especially rural areas, but not in the country as a whole.

# 3

# Recovery and Reconstruction Plan and Measures

## Planning Concepts

Postdisaster reconstruction emphasized its scientific basis and its concern with people as primary. In keeping with these emphases, urban and rural housing reconstruction in Sichuan was organized around five concepts: "people foremost and livelihood first," "scientific assessment and classified guidance," "quality secured and safety first," "comprehensive coordination and optimized living environment," and "creative mechanism and cooperative reconstruction."

**"People foremost, livelihood first"**

Postquake recovery planning in Sichuan made housing reconstruction for the affected population into the priority. Reconstruction was meant to proceed as quickly as possible relative to actual conditions on the ground and the need for safe, economical, comfortable, and land-saving housing. Implementation of building technical standards, building quality, supporting facilities, housing reconstruction planning, and funding arrangements as well as land use were also meant to be taken into account so as to quickly restore normal living conditions and more gradually improve the living environment.

**"Scientific assessment, classified guidance"**

Reconstruction planning dictated that postdisaster assessment and appraisal of urban and rural housing, disposal of damaged housing, and the implementation of relevant technical standards be conducted in accordance with Classification of Earthquake Damage to Buildings and Special Structures ([90] No. 377).

**"Quality secured, safety first"**

According to reconstruction planning, rebuilt buildings were to be designed to suffer no damage in a small quake, need only slight repair needed in medium-size quake, and not collapse in a large quake; thus reconstruction planning made structural safety and disaster prevention and reduction a priority in both urban and rural housing. Reconstruction emphasized disaster-prevention designs, but also encouraged adoption of new materials and new technology to ensure that rebuilt houses conformed to relevant technical standards.

**"Comprehensive coordination, optimized living environment"**

Reconstruction of urban and rural housing, as well as the organization of urban and rural communities, was meant to restore the living standards of urban and rural residents and to be convenient, economical, and comfortable. The planning and design of both supporting facilities and the housing environment were required to follow the Code for Planning and Design of Urban Residential Areas, issued by the Ministry of Housing and Urban-Rural Development in 1993.

**"Creative mechanism, cooperative reconstruction"**

Reconstruction planning encouraged the affected populations to contribute to housing reconstruction themselves. At the same time, the reconstruction mechanism organized by the government ( based on the operation of the market and investment of diversified resources) made different types of loans and community assistance available, depending on location, housing type, and form of ownership.

## Planning Objectives

As indicated by the State Council, one goal of reconstruction planning was to complete urban and rural housing reconstruction within three years. The main task of urban and rural housing reconstruction, therefore, was to solve the housing problems within the specified time, not only restoring prequake standards but also further optimizing the living environment by securing building safety, promoting building quality, improving support facilities, designating emergency shelters, and employing new technologies.

**Scale of reconstruction**

New housing was constructed as follows: 2.90 million units in Sichuan, 2.59 million units in Gansu, and 50,190 units in Shaanxi.

Urban housing reconstruction led to 720,030 new houses with a total area of about 54.89 million $m^2$; housing in Sichuan made up 52.91 million $m^2$, in Gansu 1.70 million $m^2$, and in Shanxi 282,000 $m^2$. The overall area of reinforced housing was 47.13 million $m^2$, with Sichuan making up 44.37 million $m^2$, Gansu 2.20 million $m^2$, and Shanxi 559,000 $m^2$.

Rural reconstruction led to new housing for 2.19 million households, with Sichuan making up 1.91 million, Gansu 229,800, and Shanxi 47,200. About 1.68 million households had their housing reinforced, 1.44 million in Sichuan, 118,800 in Gansu, and 12,100 in Shaanxi.

**Yearly plan**

The plan broke down reconstruction goals by year, as follows:

Year one: Urban housing reconstruction should complete 80 percent of the total reinforced housing and 30 percent of new construction; rural housing reconstruction should complete housing reinforcement entirely, complete 60 percent of rural housing reconstruction, and ensure that the affected population has housing in the winter.

Year two: Urban housing should complete housing reinforcement entirely and complete 70 percent of housing reconstruction; rural housing reconstruction should be entirely completed.

Year three: All urban and rural housing reconstruction should be completed.

## Planning of Reconstruction Technical Standards

**Classification of housing reconstruction**

The categories in Classification of Earthquake Damage to Buildings and Special Structures guided classification of damaged housing. Housing was labeled collapsed, severely damaged, or moderately damaged and either rebuilt, reinforced, or repaired and maintained depending on the degree of damage.

*Rebuilding*

Rebuilding was specified for all collapsed houses, houses in which the majority of load-bearing components had collapsed or were severely damaged, urban houses appraised as severely damaged, and rural houses appraised as severely or moderately damaged.

*Reinforcement*

Reinforcement was specified for houses appraised as moderately damaged after the quake, houses in which the majority of load-bearing components was cracked, and those in which non-load-bearing components were severely damaged.

*Repair and maintenance*

Houses in this category are in need of technical guidance as well as repair and maintenance; they include houses appraised as slightly damaged, undamaged, or basically undamaged that are not involved in postdisaster housing reconstruction planning.

**Relocation of urban and rural housing**

The plan specified that the following be taken into consideration when relocating housing to ensure a practical scientific basis for decisions:

- the relation between relocating the affected population, clearing the site, protecting farmland, and restoring production;
- the relation between housing reconstruction and any disaster prevention system;
- the relation between on-site reconstruction and nearby reconstruction;
- the relation between current recovery and reconstruction efforts and long-term sustainable development; and
- the relation between recovery and reconstruction efforts and urbanization.

## Planning of Security Mechanism

To make reconstruction possible, the central and local governments made use of various policies, involving subsidies, taxes, finance, and land, as well as material, technological, and personnel support.

**Raising of needed funds**

According to the reconstruction budget, a total of Y 273.0 billion was needed for urban and rural housing, of which Y 248.5 billion was allocated for Sichuan, Y 19.6 billion for Gansu, and Y 4.9 billion for Shaanxi. Of the Y 273.0 billion, Y 123.0 billion was for urban housing reconstruction and Y 150.0 billion for rural housing reconstruction.

Funding for urban and rural housing reconstruction was accomplished through residents' self-financing, government financial support, the "twin assistance" (counterpart support) program, civil society contributions, domestic bank loans, emergency loans from abroad, some forms of innovative financing, and other methods.

**Tax concessions**

A series of tax concessions was put in place to facilitate reconstruction:

- The land for housing reconstruction is exempted from urban land use taxes and from land appreciation tax when transferred.
- Farmland used for rural housing reconstruction is exempted from farmland use taxes.
- Contracts and other documents related to the survey and design of construction projects (such as construction engineering contracts, ownership transfer documents, lease contracts for low-cost housing arranged by the government) are exempted from the stamp tax.
- Damaged houses are exempted from the deed tax; if residents affected by the earthquake purchase low-cost housing, they pay half of the deed tax.

- With the consent of provincial governments, damaged property and land are exempted from property tax in 2008, urban real estate tax, and urban land use tax. Taxpayers who are exempted from paying tax in a given year can deduct that amount from the taxes due the next year.

**Government funds and administrative and institutional fees**

To facilitate reconstruction, all reconstruction of low-cost housing, low-rent housing, and on-site housing was exempted from administrative fees and government funds. Provincial governments were also expected to waive local administrative fees.

**Financial support**

To facilitate reconstruction, preferential housing loan policies were implemented in quake-hit areas. All commercial banks provided preferential housing loans for government-organized housing reconstruction. Banks were encouraged to provide loans for rural residents to rebuild and repair their houses and to provide preferential housing loans for rural residents with the ability to repay. The loan rate was reduced by 40 percent of the rate for fixed loans, and down payments were reduced by 10 percent.

**Changes in land policy**

To facilitate reconstruction, a series of changes and additions was made to existing land policies:

- Compensated land use fees and land-leasing fees were waived for all types of housing construction for rehabilitation.
- The land used for nonprofit housing construction was allocated by governments.
- Land was allocated in advance for urban housing reconstruction projects, as was done following past earthquakes; pending procedures were simplified according to related regulations.
- If planning and reconstruction involved land previously used for construction, land use and ownership were not altered. The related land adjustment and replacement were to be performed under the principle of exchange of equal value.

**Counterpart support**

Under the twin assistance (counterpart support) mechanism, designated provinces were expected to assist rural and urban housing reconstruction. Housing safety appraisal, organization of building materials, and supporting funds were to be implemented in advance.

## Summary

This chapter described postdisaster reconstruction planning strategies, methods, and measures. It described the plan's emphasis on people's needs and on the scientific basis for reconstruction; the key objectives of reconstruction planning; and the classification, scale, budget, and schedule for reconstruction projects. It also explained technical construction standards, including technical standards for damaged housing disposal, relocation of housing reconstruction, and construction of urban and rural housing. Finally, it described the scheduled policy security mechanism, including funding methods, progress control, quality supervision, risk control, and safety management as well as subsidy policy, taxation concession, land policy, and housing policy.

# 4

# Evaluation Methodology

## Evaluation Index System for Housing Reconstruction

In planning after the Wenchuan Earthquake, the State Council put great emphasis on urban and rural housing reconstruction and had housing reconstruction projects implemented under the guidance of special planning. This chapter presents an evaluation index system for evaluating the reconstruction projects scientifically and objectively.

**Numerical indicators**

The two main numerical indicators used by the system involve classification and scale.

*Classification of housing reconstruction*

As the previous chapter indicated, the Classification of Earthquake Damage to Buildings and Special Structures specified that houses appraised as collapsed or seriously damaged were to be rebuilt on-site or off-site; houses appraised as moderately damaged were to be reinforced; and house appraised as slightly damaged were to be repaired by the owners themselves.

*Scale of reconstruction*

As the previous chapter indicated, the number of newly built houses called for in the plan was 2.90 million in Sichuan, 2.59 million in Gansu, and 50,190 in Shaanxi. The plan for urban housing reconstruction called for 720,030 new houses with a total area of about 54.89 million $m^2$, with housing in Sichuan making up 52.91 million $m^2$, Gansu 1.70 million $m^2$ and Shanxi 282,000 $m^2$. The overall area of reinforced housing was 47.13 million $m^2$, with Sichuan making up 44.37 million $m^2$, Gansu 2.20 million $m^2$, and Shanxi 559,000 $m^2$.

The plan for rural reconstruction dictated new housing for 2.19 million households, with Sichuan making up 1.91 million, Gansu 229,800, and Shanxi 47,200. About 1.68 million households were to have reinforced housing, 1.44 million in Sichuan, 118,800 in Gansu, and 12,100 in Shaanxi

**Progress indicators**

The Sichuan provincial government work plan included reconstruction of nearly 500 million $m^2$ of housing, which was to start in 2008 and be generally completed by 2010. The three-year reconstruction plan was challenging. To stay on schedule, the plan for urban and rural housing reconstruction was laid out as follows:

In 2008: Overall planning of urban and rural housing reconstruction as well as yearly plans for 2008 – 2010 should be made. All the evaluation for moderately damaged and seriously damaged buildings as well as reinforcement of moderately damaged buildings should be finished in both urban and rural areas. Site clearing and construction preparatory work for urban housing reconstruction should be finished. Transitional housing and low-rent housing construction should begin as soon as possible. The newly built projects should account for 20 percent of overall reconstruction. Rural housing reconstruction should be completed in the areas not considered most severely damaged; this should account for 60 percent of rural housing reconstruction.

In 2009: Reinforcement of seriously damaged urban housing should be done. All the urban housing reconstruction projects started in 2008 should be completed and accepted. The rest of the housing reconstruction should be started. In addition, public supporting facilities and all the rural housing reconstruction should be completed and accepted.

In 2010: All the supporting facilities and all the urban and rural housing should be finished and accepted.

**Quality indicators**

The two main quality indicators are standards for reconstruction and reinforcement.

*Housing reconstruction standards*

Relocated housing should avoid areas where there are seismically active faults, risk of hydrogeological disasters, pollution sources, and hazardous substances.

All phases of housing reconstruction (planning, design, construction, and acceptance) should follow the seismic fortification intensity standards imposed after the earthquake. The design should meet the needs of earthquake prevention and safe evacuation of residents in an emergency. Rural housing reconstruction should conform to related regulations determined by the State Council, which aim to remove hidden dangers, improve rural living conditions, and enhance the rural residents' ability to withstand disasters.

The construction and inspection of new housing should strictly adhere to current regulations. The designer should strictly adhere to the seismic fortification code; the builder and the supervisor should also strictly adhere to construction drawing and compulsory building standards.

*Housing reinforcement standards*

Relevant institutes should make various technical plans available, to be used based on the degree of damage, structural safety, service life, reinforcement cost, and geological conditions. The plans should take into account the local traditional characteristics.

Reinforced housing should reach seismic fortification and building quality standards. Urban housing reinforcement should be done by qualified construction enterprises. Rural housing reinforcement should have a reinforcement plan, and the government should organize professionals to provide guidance.

Building materials used in reinforcement projects should conform to relevant standards and regulations. The project acceptance should also conform to relevant regulations.

**Funding indicators**

As indicated in the last chapter, the total amount needed to complete rural and urban housing reconstruction is Y 273.0 billion; Y 248.5 billion in Sichuan, Y 19.6 billion in Gansu, and Y 4.9 billion Shaanxi. Of the total sum, urban housing reconstruction requires Y 123 billion and rural housing reconstruction Y 150 billion.

Funding methods for rural and urban housing reconstruction include residents' self-financing, fiscal investment, twin assistance (counterpart support), domestic bank loans, and some forms of innovative financing.

## Evaluation Methodology

This report employed both qualitative and quantitative research methodologies. The following are the specific methods used:

(1) A literature review was undertaken to analyze postdisaster reconstruction policies and regulations issued by both the central government and local administrations, and to explore policy guidance and the main elements guiding reconstruction progress.

(2) Questionnaires were designed as part of a survey to investigate reconstruction implementation at the grassroots level and evaluate the connection between rural housing reconstruction and new construction in rural areas.

(3) Site investigation, which included interviews with residents affected by the earthquake and with local administrators, was conducted to collect first-hand data, photographs, and related materials.

(4) Case study was undertaken to better understand the real needs of the affected population so as to optimize the postdisaster reconstruction outcomes.

## Summary

This chapter described the housing reconstruction index system, based on four types of indicators: numerical, progress, quality, and funding. It also explained the qualitative and quantitative research methodologies (comparative analysis, literature review, survey, site investigation, and case study) used in carrying out the evaluation.

# 5

# Evaluation of Recovery and Reconstruction

## Outcomes of Housing Reconstruction

Under the leadership of the central and local governments, urban and rural housing reconstruction was completed in less than three years, providing housing for 1.45 million rural households and 250,900 urban households and housing reinforcement for 2.21 million rural households and 1.34 million urban households. The goal of ensuring a home for each household was largely realized – a truly significant achievement.

## Evaluation of Policy and Surroundings

Many factors contributed to the reconstruction outcomes (which in turn have contributed to the stable development of quake-hit areas). The three factors that had most to do with reconstruction outcomes are policy support, social support, and national spirit.

**Policy support**

A total of 127 documents related to post-earthquake reconstruction (37 issued by the central government, 90 by the Sichuan provincial government) was collected for this study. Documents issued by the central government stipulated the principles, process, and objectives of postdisaster reconstruction from the macro level, while documents issued by the Sichuan provincial government put more emphasis on the details of reconstruction objectives and implementation.

The document analysis suggests that policies issued after the earthquake had an important effect on outcomes. Six principles in particular guided urban and rural housing reconstruction: livelihood as a priority, scientific planning, comprehensive coordination, self-reliance, government support, and community support. After the quake, both central and local administrations actively investigated and evaluated housing damage, then started reconstruction by properly allocating personnel, material, and funds. The reconstruction was such a huge project that it required a scientific basis; this is embodied in the government policies guiding the housing reconstruction.

**Social support**

The support offered by the society as a whole after the earthquake also had a significant effect on outcomes. All segments of the community joined to help with reconstruction. All kinds of foundations, volunteers, doctors, counseling staff, and celebrities provided assistance and contributed to the reconstruction of quake-hit areas. Many enterprises and entrepreneurs with a strong sense of social responsibility also joined the reconstruction, and international rescue groups, the Red Cross, and relevant agencies of the United Nations offered their assistance as well.

**National spirit**

China's national spirit was the third important contributor to the reconstruction outcomes. The national spirit enabled the Chinese to confront an enormous disaster without being defeated. Their persistence and achievements lifted people's morale and leant support to post-disaster reconstruction. Everyone involved in the reconstruction work overcame many challenges to complete urban and rural housing reconstruction.

## Evaluation of Progress

By the end of 2011, urban and rural housing reconstruction was completed and the goal of a home for each household was realized. By the end of 2008, housing reinforcement for 2.21 million rural households was completed. By the end of 2009, housing reinforcement for 1.34 million urban households was completed. By the beginning of 2010, reconstruction of damaged rural housing was completed; and by May 2010, 85.15 percent of urban housing reconstruction was completed, four months ahead of schedule. By the end of August 2011, 3.67 million rural households and 1.58 million urban households had moved into safe and comfortable permanent housing, meaning that housing problems had been solved for 99.54 percent of the affected population. The completion of urban and rural housing reconstruction helped restore living and production conditions, improved livelihoods, contributed to social stability, and promoted socioeconomic development in the affected areas.

## Evaluation of Quality

The Ministry of Housing and Urban-Rural Development issued documents to stipulate the standards for the quality of postdisaster reconstruction projects. Sichuan, Shaanxi, and Gansu jointly issued Measures for Quality Administration of Postdisaster Reconstruction Projects of the Wenchuan Earthquake, and Sichuan also issued its own document, Checklist of Construction Quality of Post-disaster Reconstruction in Sichuan, which calls for detailed inspection of projects, outlines the main responsibilities of construction workers, and specifies standards for construction. Other local administrations of affected areas also issued related regulations to guarantee quality management, and all project implementation units released detailed measures to ensure the construction projects' quality.

The various measures concerned with quality specified the following:

(1) Quality control of reconstruction projects should strictly follow relevant regulations and should offer a lifetime guarantee of quality. The administrative leader of the project, project legal representatives, and material suppliers, as well as the companies involved in design, construction, and supervision, are all responsible for project quality according to their specific responsibilities.

(2) Administrative departments at all levels and project participants should strictly execute construction management procedures, including those involving project location, design, bidding, and construction permits, to ensure construction quality meets national standards.

(3) Construction units should strictly follow the laws, regulations, technical standards, and contract provisions of construction projects, and should assume responsibility for quality. A quality-inspection system should be set up and put into effect during the construction process.

(4) Administrative departments of construc-

tion at all levels should supervise construction projects' quality according to relevant regulations.

(5) Administrative departments of construction should supervise and inspect the quality management of reconstruction projects from time to time. Projects that have not established complete systems of responsibility should be asked to rectify the omission within a fixed time. Construction units found not following technical standards are required to stop work, and they risk having their qualification certificate downgraded or revoked. If an accident related to quality occurs, relevant units are to bear the responsibilities and consequences.

(6) Construction quality inspection agencies should make inspection plans according to specific construction projects, and should assign inspectors to supervise project quality, implementation of construction building standards, handling of quality defects, and project acceptance.

(7) Administrations at all levels are responsible for project quality. Construction units are to take the blame for any accidents in construction, and the relevant administrators are also to be held responsible.

(8) Administrators at all levels as well as administrative authorities of construction should emphasize the construction project quality inspection system. Measures for construction quality administration should be made to further guarantee the safe implementation of postdisaster reconstruction.

(9) Evaluation of damaged housing should be carried out. The relevant departments should organize experts to evaluate all the damaged housing and related public facilities such as water supply, gas supply, power supply, and other lifeline systems. Based on evaluation results, constructors or administrative departments of project management should have qualified design units draw up practical housing reinforcement plans so as to prevent secondary disasters.

(10) The quality of construction drawings should be guaranteed. The quality of construction depends on the quality of the design. Relevant departments should be careful not only about choosing designing units with qualifications, but also about the budget for the design.

(11) The quality of the construction company should be guaranteed. The quality of the construction company has a direct impact on the construction. Once the project is approved and project bidding begins, there are four steps involved in choosing a qualified construction company. First, relevant departments should listen to the company explain their technology, equipment status, financial situation, and measures to be taken for the projects; second, relevant departments should check the construction quality of the company's previous projects or projects under construction; third, the relevant departments should investigate the company's equipment, technology, enterprise class, and qualification certificates; and fourth, the relevant departments should interview the company and collect reviews about the company. Favoritism is strictly forbidden in awarding bids.

(12) The signing of construction contracts should be guaranteed. Once the construction company is confirmed, the contracts should be signed to legalize the rights and duties of all parties. The contract must be reported to relevant authorities before signing and must be notarized afterward.

(13) The inspection of construction quality should be guaranteed. An inspection and reporting system for construction quality should be established to improve the transparency of quality inspection.

(14) Quality control should be guaranteed. To guarantee the key objectives, both segmentation control and dynamic control are employed. During the construction, a PDCA (plan, do, check, act) cycling quality-control mechanism should be strictly implemented.

(15) The acceptance of construction should be guaranteed. Acceptance is the last step of the construction and should be carried out in accordance with agreed upon standards.

## Evaluation of Safety

Three major steps were taken to ensure the safety of reconstructed rural and urban housing.

First, new standards for seismic fortification intensity were implemented and fortification standards were improved. Ten standards were issued in response to the Wenchuan Earthquake to rectify structural parameters and measures and to improve the fortification standards and antiseismic features of structures.

Second, decisions about relocation of reconstructed urban and rural housing relied on scientific evidence to avoid secondary disasters. After the earthquake, the unstable geological conditions led to frequent secondary disasters such as landslides, which threatened as many as 1.06 million people in 24 town prefectures. Sichuan provincial officials conducted safety evaluations of potential housing reconstruction sites to avoid seismic faults, frequent secondary disasters, engineering geological disasters, hydrogeological disasters, noise and other pollution, radiation, and other hazards. To account for hidden geological hazards that cannot be avoided, appropriate changes were made to land allocation. For instance, green land, parks, and other landscape facilities were installed where living and public service facilities used to be.

Third, administrative departments of construction at all levels provided technical guidance and service for affected populations to guarantee construction quality and seismic fortification intensity. The Sichuan provincial Department of Construction released 14 guidance documents and technical regulations, compiled Design for Rural Housing Reconstruction and Seismic Structure of Rural Housing, and provided 300 construction designs of rural housing for rural households. This is the first time that Sichuan issued systematic regulations for seismic fortification intensity of rural housing. Meanwhile, administrative departments of construction at all levels organized professionals to provide technical guidance for rural residents, and a total of 90,000 construction workers in rural areas received technical training.

## Evaluation of Cooperation

Due to the huge cost, challenging tasks, and tight schedule of reconstruction, it was difficult for local governments and the affected residents to conduct and complete the reconstruction themselves. The central government and other provinces provided timely support to ensure the smooth implementation of all the reconstruction projects. Eighteen provinces acting as donors through the twin assistance program took on a significant political responsibility and designed, helped to construct, and promoted the reconstruction projects. A mechanism for regular contact was set up to strengthen the connection between administrative departments of construction in the quake-hit areas and the provincial and municipal departments of construction of the 18 provinces involved in the twin assistance program. Meanwhile, the administrative departments of construction gave the top priority to funding, reconstruction, and reinforcement of urban and rural housing. Within two years, housing reconstruction was completed.

The twin assistance program not only supported the construction work of reconstruction projects; it also supported and helped to diffuse the concepts, mechanisms, and management skills related to construction. All kinds of special training – in various industries, in construction of new rural areas, and in administration – were organized to further equip local officials with advanced concepts and management capabilities. It was the twin assistance program that introduced the emphasis on technology, talent, and innovation.

Hong Kong SAR and Macao SAR also took the initiative to provide assistance for reconstruction. The chief executives of both visited the quake-hit areas and held many discussions about aid. Funds from Hong Kong SAR and Macao SAR were mainly used for the 18 worst-hit prefectures and for the 12 worst-hit prefectures evaluated by the Sichuan provincial administration. The international community also provided significant support for the recovery and reconstruction of Sichuan.

## Case Study

The two case studies that follow grow out of research done between March and May 2011, when members of the project team administered a survey focused on the process and achievements of urban and rural housing reconstruction as well as rural reconstruction generally.

The survey sampling covered the ten worst-hit prefectures – Wenchuan, Beichuan, Mianzhu, Shifang, Qingchuan, Maoxian, Anxian, Dujiangyan, Pingwu, and Pengzhou – which included 30 towns and 50 villages. The sample consisted of 700 quake-affected households in both urban and rural areas. A total of 700 questionnaires was sent out, and 649 were collected upon completion, for a return rate of 92.7 percent. The collected data are statistically significant due to the extensive coverage and large quantity of samples.

**First Case: Postdisaster rural housing reconstruction after landslides in Qingping Township, Mianzhu County**

After landslides occurred in Qingping Township, Mianzhu County, on August 13, 2010, 603 households needed reconstructed housing. Based on the regulations governing construction of new rural areas issued by the Sichuan provincial administration, the reconstruction combined rural housing construction, industrial development, infrastructure and public service facility construction, and community construction; the goal was to build a new rural community with an appropriate population, strengthened industries, beautiful environment, scientific and democratic administration, and urban-rural integration pattern.

Centralized planning and construction were conducted at six relocating shelters after consulting with departments of construction and with experts in flood and earthquake prevention and disaster reduction. In keeping with the principles of respect for science, nature, and community preference, planning sought to guarantee people's safety and ensure that the reconstruction would avoid seismic fracture zones, geological disaster zones, and flood areas.

Based on key objectives of construction of new rural areas, the rural housing reconstruction of Qingping Township was designed by the Urban and Rural Planning and Design Institute of Sichuan. Under the plan, the following villages were to have housing built: Linjiakan, 60,000 $m^2$ of housing for 240 households – details of reconstruction are given below; Daxiao-jianping, 62,031 $m^2$, 110 households; Zhoujiakan, 25,346 $m^2$, 120 households; Wajiaping, 13,340 $m^2$, 102 households; and Jiangou Village Council, 2,401 $m^2$, 18 households.

The reconstruction of rural housing in Linjiakan was located at Yuantong Village near the market; it not only made full use of urban infrastructure, public facilities, and production service facilities, but kept construction costs low and improved the quality of construction in new rural areas. The reconstruction plan called for construction of 30 four-story buildings, which covered 60,030 $m^2$ of ground and served 240 households. The average area per person was 30 $m^2$, at a cost of Y 850 per $m^2$. The Mianzhu municipal administration put an emphasis on improving the living environment and developing industries as well as reconstructing housing.

The construction work was accomplished by overall government administration and rural residents' self-construction. Residents were organized to choose and confirm locations, and groups of eight households set up construction committees to negotiate with construction companies and sign construction contracts. Meanwhile, authorities of construction were responsible for the inspection of the projects' quality and safety.

**Second Case: Urban housing reconstruction using combination and reconstruction mode in Longtanwan Community, Dujiangyan City**

According to Implementation of Urban and Rural Housing Reconstruction of Wenchuan Earthquake, a document issued by the Dujianyan municipal administration, affected populations were allowed to choose off-site replacement housing or on-site reconstruction with approval of two-thirds of residents in the same building. However, the various forms of home ownership and housing structure made achieving unanimity difficult. Therefore, after a careful investigation of the situation and consideration of residents' ideas, the municipal administration put forward a new concept: residents interested in on-site reconstruction would be allowed to freely combine with others who shared their housing preferences and then implement the reconstruction as a group.

The concept of combination and reconstruction soon gained approval from all the stakeholders, and it was implemented successfully in the urban reconstruction project in Jinyangxinyuan, a new neighborhood in Longtanwan Community. Such new reconstruction modes soon became the model for other seriously affected areas. The success of the combination and reconstruction mode reflects not only the emphasis on people's livelihoods and on scientific planning, but also the importance of adapting planning to local conditions.

## Summary

This chapter described the outcomes of postdisaster urban and rural housing reconstruction. It also evaluated the relevance, efficiency, and effectiveness of urban and rural housing reconstruction, looking specifically at policy security, projects' progress, quality guarantees, safety management, issues of cooperation, and risk control.

The outcomes can be summed up as follows:

(1) Six principles seem to have been the basis for reconstruction implementation: livelihood as a priority, scientific planning, comprehensive coordination, self-reliance, government support, and community assistance.

(2) Understanding the importance of construction quality in reconstruction, local governments and administrative departments of construction strictly

followed construction procedures and completely implemented quality inspection measures to guarantee the safety and reliability of reconstruction projects.

(3) The twin assistance program that emerged during the process of the reconstruction ensured that reconstruction could proceed based on scientific principles, as well as quickly and safely.

The chapter also included two case studies that show aspects of both urban housing reconstruction and rural housing reconstruction. The first describes postdisaster rural housing reconstruction after landslides in Qingping Township, Mianzhu County. The second describes the combination and reconstruction mode used in Longtanwan Community, Dujiangyan City.

# 6

# Evaluation of Program Impacts

## Program Impacts on Local Economy

Reconstruction of urban and rural housing affected local economic development, industrial structure, and employment.

**Reconstruction's impact on economic development**

Between 2007 and 2011, the GDP of Sichuan doubled to over Y 2 trillion. Local financial general revenue doubled between 2008 and 2011 to Y 200 billion. During the same three-year period, economic indicators in the six worst-hit districts also enjoyed a sharp increase; for instance, the local GDP of the six worst-hit districts was 1.95 times higher than it was prior to the disaster, local financial general revenue increased by 239 percent, urban per capita disposable income increased by 170 percent, and rural net per capita income increased by 175 percent. These figures show that, compared to predisaster conditions, the quake-hit areas experienced significant improvements in basic living conditions and huge gains in socioeconomic development.

By February 25, 2012, 99 percent of the Sichuan reconstruction projects included in the national postdisaster reconstruction plan (a total of 29,692) had been finished, and 99.5 percent of the budgeted investment (Y 865.8 billion) had been used. In addition, 13,647 reconstruction projects in the 12 worst-affected prefectures and 91 moderately affected prefectures were basically completed. A total of Y 1.7 trillion was used for reconstruction and development in 142 quake-affected prefectures. In 2011, the six worst-hit areas experienced huge growth in local GDP, local financial general revenue, urban per capita disposable income, and rural net per capita income; the sharpest increase was in local financial general revenue, which grew by 239 percent. By 2011, 173 corporations listed among the top 500 in the world had established branches in Sichuan. Meanwhile, Sichuan took in Y 700 billion in domestic investment as well as US $11 billion in overseas investment. Export and import trade also saw a sharp increase, of 54.8 percent. In 2011, tourism revenue totaled Y 240 billion in Sichuan, far exceeding that prior to the quake.

During the postquake reconstruction, the combination of reconstruction with industrialization, urbanization, and the building of new rural areas was fully operative. In addition, great emphasis was placed on the enhancement of superior industries and the introduction of strategic emerging industries. In order to strengthen the characteristics and functions of industrial parks, the Sichuan provincial administration issued the Plan for the Distribution of Industrial Productivity and Industrial Restructuring of Quake-Affected

Areas in Sichuan, which regulates the direction of regional industrial development and limits the number of leading industries and supporting industries in each industrial park to one or two only; the goal is to guide industrial parks to form industrial chains, which can in turn lead to further optimization of the industrial park districts. These districts can then constitute industrial clusters, and these in turn contribute to the formation of industrial belts. Currently, a large number of important industrial parks, industrial clusters, and industrial belts are emerging, each with a value of more than Y 1 trillion, for fields like telecommunication, automobile manufacturing, and petroleum and chemical as well as new energy. At present, industrial concentration reaches 64 percent, with the superior industries increasing Y 1 trillion each year since 2008.

Industrial development increased by 22.3 percent in Sichuan in 2011, putting that province in second place nationwide. During the reconstruction, the focus on the development of superior industries, tourism, special cultural industries, and special agriculture in the affected areas has contributed to sustainable development. So far, around 3,039 industrial projects have been completed and put into use. For instance, the frame of the west China integrated transportation hub has been gradually established, Dongfang Turbine has invested Y 5 billion in rebuilding the Hanwang production base, and the Aba aluminum factory is producing 110,000 tons of electrolytic aluminum. In addition, under the twin assistance program, Y 1 billion was invested in 11 industrial parks (including Dujiangyan Yizhangjiang Hi-Tech Park and Beichuan – Shandong Industrial Park) and a large number of industrial projects was introduced.

**Reconstruction's impact on industrial structure**

In 2009, the total investment in postdisaster reconstruction in the 51 worst-hit prefectures amounted to Y 379.4 billion, a 175.5 percent increase over the previous year. The structure of industrial investment was different in the 51 worst-hit prefectures than in Sichuan Province as whole. While secondary industry decreased and tertiary industry increased both for the quake-hit areas and for the province as a whole, primary industry decreased in the quake-hit areas and increased in the province generally. The investment in primary industry in the 51 worst-hit prefectures amounted to Y 13.9 billion, an increase of 66.5 percent, and 109 percent slower than the increase in overall investment of quake-hit areas, but still 4.8 percent faster than the increase in primary industry in Sichuan Province. The investment in secondary industry in the 51 worst-hit prefectures amounted to Y 126.6 billion, an increase of 79.2 percent, and 53 percent slower than the increase in overall investment in quake-hit areas, but 31.2 percent faster than the increase in investment in secondary industry in Sichuan. The investment in tertiary industry in the 51 worst-hit prefectures amounted to Y 233.5 billion, an increase of 187.8 percent over the previous year and representing 61.5 percent of the overall investment in quake-hit areas. In general, the increase in the three major industrial sectors in the worst-hit areas was obviously higher than that in Sichuan as a whole. Prompted by recovery and reconstruction investment, tertiary industry showed a sharp rise.

During the reconstruction, the investment mainly focused on livelihood and infrastructure, which thoroughly changed the inner demand structure. Meanwhile, the focus of investment structure also changed, to livelihood and community investment from the industrial investment of the previous years. The older structure appears to be returning after the completion of reconstruction.

### Reconstruction's impact on growth

The three-year postdisaster reconstruction was a driving force behind Sichuan's development, and also strengthened and deepened its cooperation with other provinces. It provided a new mechanism for fast recovery in the face of frequent disasters and established a pattern of cooperation and openness. From August until December 2008, Sichuan sent delegations to visit the 18 provinces and districts involved in the twin assistance program to recruit investment of Y 246 billion yuan. The Western China International Fair (WCIF) played an important part in strengthening cooperation. In 2008, at the ninth annual WCIF, Sichuan postdisaster reconstruction projects attracted many well-known international corporations. Cisco Systems, Inc., established the goal of investing Y 300 million over three years, and other private enterprises signed on to 16 reconstruction projects, for a total investment of Y 2.7 billion. In 2009, at the 10th WCIF, the six worst-hit municipalities attracted investment of Y 224.2 billion, representing 47.65 percent of the total contracts for the province.

### Reconstruction's impact on employment

Postdisaster reconstruction provided opportunities for surplus labor in the affected areas. According to statistics from provincial governments, postdisaster reconstruction appropriately resettled in off-site locations 200,000 farmers who had lost their land in the earthquake and needed new employment. Altogether it employed more than 1.7 million people in the affected population. The increase in job opportunities promoted local economic development.

However, with the completion of investment in fixed-asset property, how to maintain the high employment rate in the quake-affected areas became an issue. The Sichuan provincial administration made a five-year plan that aimed at sustainable development in quake-affected areas by intensifying effort to develop industry, promote employment, assist the poor, protect the environment, and foster social development.

The effort to promote employment is fivefold. First, the scale of employment should be enlarged. Any projects initiated by the government, as well as infrastructure construction projects, are encouraged to employ those affected by the earthquake. Second, support for employment should be strengthened. The government should try to provide a few positions in public service for those in need of jobs. Third, local residents should be encouraged to create businesses, and government taxation, finance, and investment policy should be designed to make entrepreneurship attractive to residents of the quake-hit areas. In 2012, the Sichuan provincial administration established a billion-yuan fund to assist and promote self-employment and employment in general. Fourth, job training programs should be strengthened to help make job seekers suitable for more job opportunities. Finally, provinces should strengthen cooperation with one another to promote employment. Toward that end, Sichuan has signed long-term cooperation contracts with 18 provinces in the twin assistance program.

## Program Impacts on Beneficiaries

Urban and rural housing reconstruction had a positive impact on beneficiaries because it improved living environments and construction safety.

### Improvement in living environments

Urban housing reconstruction greatly improved living environments, while rural housing reconstruction optimized the layout of rural areas. According to survey responses, 70 percent to 80 percent of urban and rural residents reported an improvement in their living conditions following reconstruction (figures 6.1 and 6.2).

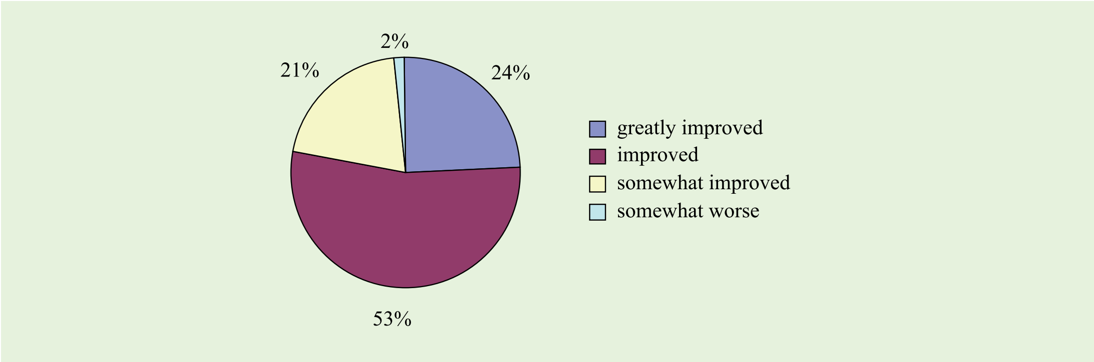


**Figure 6.1 Rural Residents' Perceptions of Living Conditions after Reconstruction**

Source: Adapted from questionnaire administered by authors.

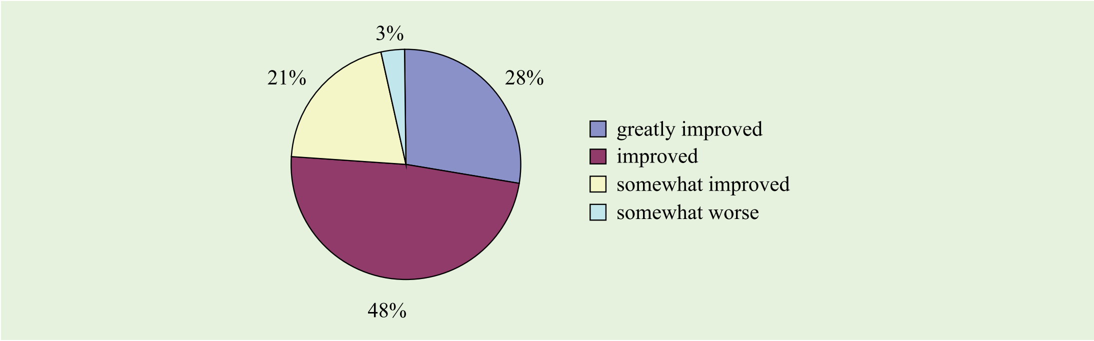


**Figure 6.2. Urban Residents' Perceptions of Living Conditions after Reconstruction**

Source: Adapted from questionnaire administered by authors.

### Improvement in construction safety

Because it implemented new seismic design regulations, urban and rural housing reconstruction promoted the seismic fortification of buildings. According to survey responses, more than 80 percent of residents are satisfied with building safety after reconstruction (figures 6.3 and 6.4).

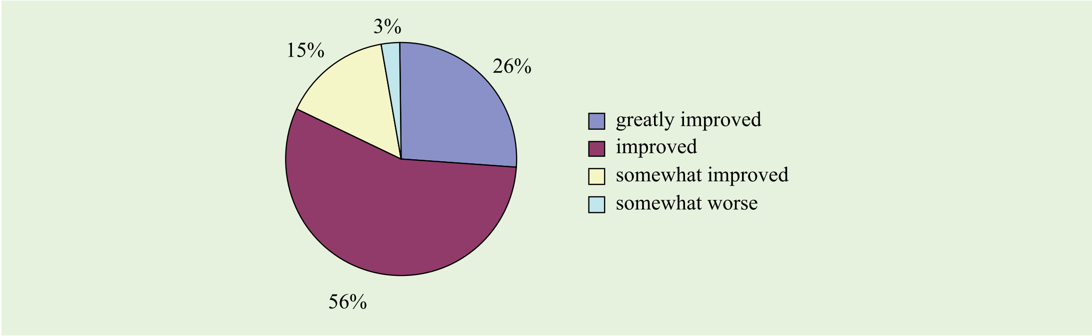


**Figure 6.3 Rural Residents' Perceptions of Housing Safety after Reconstruction**

Source: Adapted from questionnaire administered by authors.

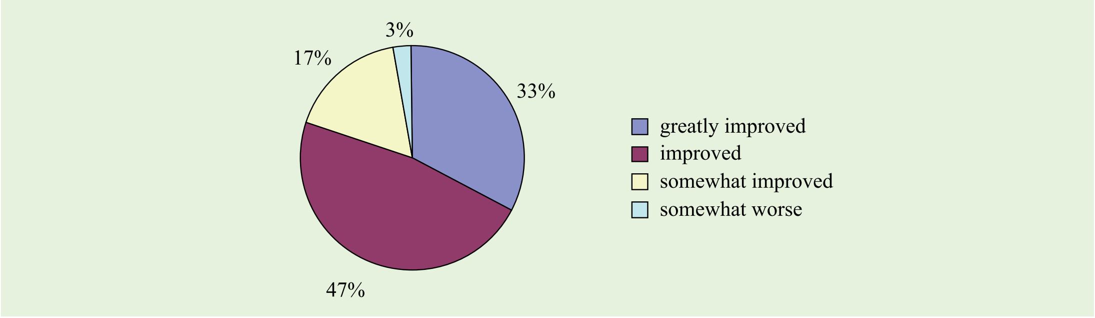


**Figure 6.4 Urban Residents' Perceptions of Housing Safety after Reconstruction**

Source: Adapted from questionnaire administered by authors.

## Program Impacts on Ability to Respond to Natural Disasters

During the reconstruction, residents of affected areas actively participated in the housing reconstruction. The technical support they received in carrying out the reconstruction work increased their ability to respond to natural disasters. According to survey responses, 80 percent of residents participated in reconstruction (figures 6.5 and 6.6). In addition, 70 percent to 80 percent of the affected population received technical support (figures 6.7 and 6.8).

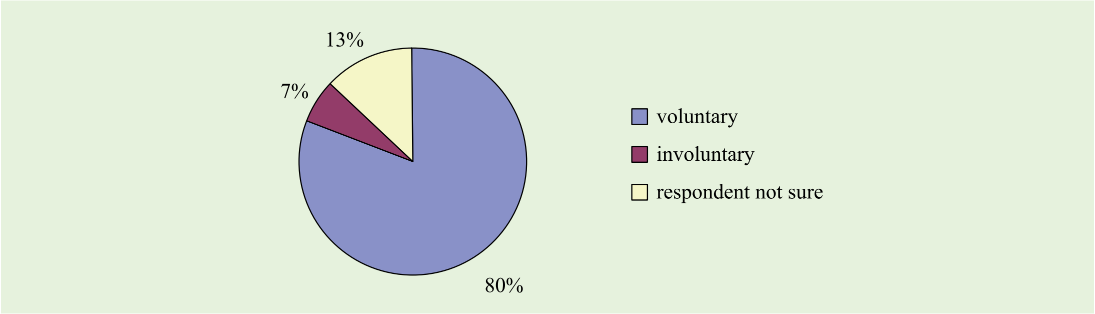


**Figure 6.5 Type of Participation in Rural Housing Reconstruction**

Source: Adapted from questionnaire administered by authors.

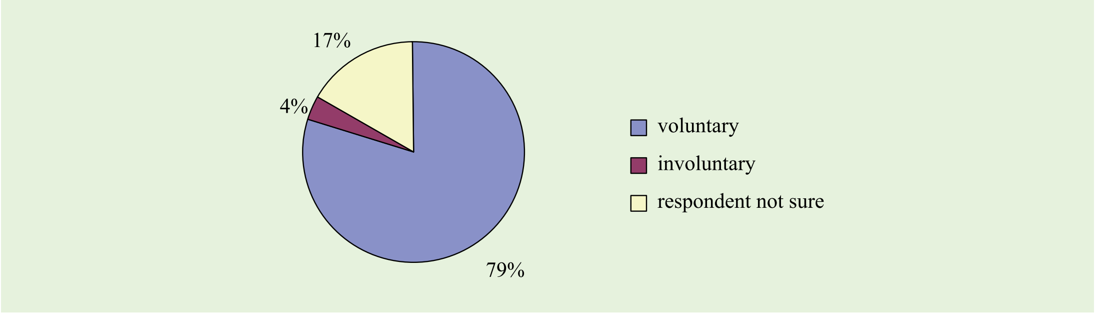


**Figure 6.6 Type of Participation in Urban Housing Reconstruction**

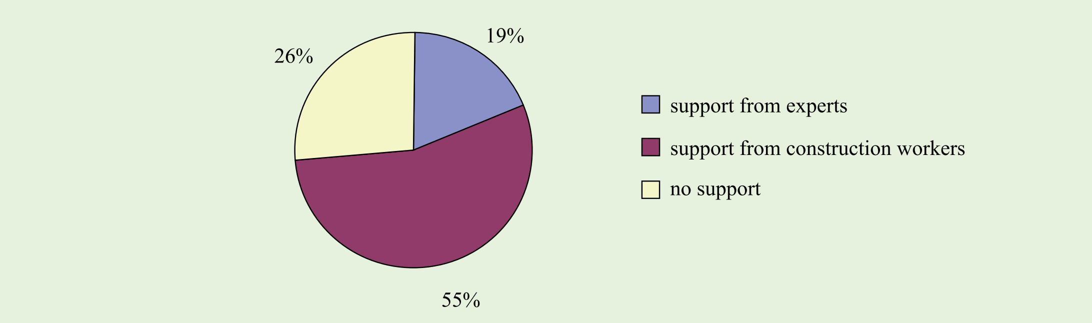


**Figure 6.7 Technical Support Received by Rural Residents**

Source: Adapted from questionnaire administered by authors.

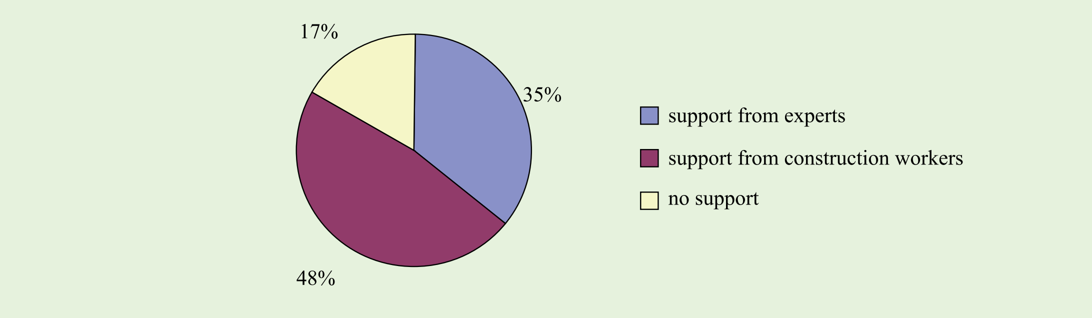


**Figure 6.8 Technical Support Received by Urban Residents**

Source: Adapted from questionnaire administered by authors.

## Program Impacts on Urbanization

Postdisaster reconstruction fully reflected a scientific concept of development. Scientific planning was done based on thorough investigation of geological conditions and socioeconomic trends. In addition, efficient reconstruction promoted the value and image of quake-hit areas. The urban construction carried out after the earthquake was safer and more sustainable than previous construction.

The postdisaster reconstruction accelerated urbanization. Reconstruction planning took implementation of urbanization strategies into account – that is, it emphasized infrastructure, improved city functionality and the urban ecological environment, and allowed residents greater access to the arts and culture.

For instance, Deyang tried to narrow the distance from eastern and middle China by promoting urbanization during the reconstruction. Its Jingyang District successfully coordinated urban and rural development by improving regional functionality, promoting the construction of a logistics center and necessary infrastructure, strengthening urban comprehensive administration, and optimizing the city center environment. The Huanghe region of Jingyang will become the major development area under the 12th five-year plan, and will feature a beautiful environment, cultural amenities, and a "garden city" lifestyle. In addition to constructing major projects like the Western International Trading Center and Xinxiwang Commercial Complex, the central business district of the Chengbei region will emphasize its urban image and functions. By 2015, Deyang will be established as the transport hub of the Chengdu-Deyang combination and city cluster and will provide the urbanized area with transportation security.

## Summary

This chapter analyzed the impacts of reconstruction on socioeconomic development and urban and rural residents' living standards. It also investigated housing reconstruction's connection to residents' ability to prevent or reduce disaster, and its connection to urbanization and urban-rural coordination. The findings of this chapter are as follows:

Postdisaster housing reconstruction had an overall beneficial impact on housing, employment, the social security system, economic development, and the urban ecological environment. Quake-affected areas showed a fast increase in economic development, with the main economic indicators of the 51 worst-hit prefectures higher than the provincial average. Reconstruction also optimized the industrial structure and enhanced employment service cooperation in quake-hit areas. Reconstruction provided job opportunities for both urban and rural surplus labor and contributed to progress in disaster prevention and reduction. Finally, construction of urban housing made cities safer, more energetic, and sustainable and improved urban functionality. [1]

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1 In the full version of this report (on which this summary version is based), this chapter also presented case studies of rural and urban housing reconstruction to highlight various reconstruction types and locations and explore the role of administrative departments at all levels. The case studies were as follows:

(1) Off-site reconstruction: New Beichuan prefecture was constructed by following higher technical standards.

(2) On-site reconstruction: Qingchuan prefecture was constructed by highlighting its local features.

(3) Partial on-site reconstruction: Yingxiu became the model of antiseismic features and disaster prevention and reduction.

(4) Reconstruction under special circumstances: Ganzi Tibetan Autonomous Prefecture, Aba Tibetan and Qiang Autonomous Prefecture, Wenchuan County, and Ningqiang County, Longnan, all faced special circumstances and met various challenges in postdisaster reconstruction.

# 7

# Conclusions and Implications

## Experience and Lessons

**Emphasis on people, livelihood, and housing**

Recognizing the central importance of housing, and with the goal of returning the affected population to permanent housing as soon as possible, the State Council emphasized "people foremost, livelihood first" in reconstruction planning following the Wenchuan Earthquake. It made urban and rural housing reconstruction, and a home for every household, a fundamental priority.

**Emphasis on scientific planning**

At all stages of postdisaster reconstruction, the importance of planning, and of a scientific basis for planning, was understood.

**Emphasis on smooth reconstruction**

Smooth progress in urban and rural housing reconstruction was ensured by using funding methods that encouraged free flow of funds (government subsidy, residents' self-financing, financial loans with preferential interest, and assistance from civil administrations), by making sure material supply was not interrupted, and by otherwise anticipating or breaking through any systemwide constraints on the reconstruction process.

**Respect for community preference**

Residents were expected to take initiative in the various stages of reconstruction; the government was to employ various construction modes that showed respect for community preference.

**Emphasis on housing safety**

Reconstruction of urban and rural housing ensured housing safety by relocating to avoid hidden hazards; by strengthening construction management to ensure quality and safety; and by adhering to technical guidance and regulations issued to guide rural housing reconstruction.

**Emphasis on a beautiful living environment to promote living standard**

Postdisaster reconstruction emphasized the standard of living and the living environment.

Urban housing reconstruction greatly improved the living environment for residents and the image of the city as whole through scientific planning and comprehensive implementation. Specifically, reconstruction of urban housing improved the city's image by shaping the landscape; paid attention to local traditions and features when designing; paid attention to color coordination to promote the beauty of the structure; and paid attention to historical heritage to promote the cultural "flavor" of the city.

Rural housing reconstruction not only solved the problem of permanent housing, but also greatly improved the living conditions and environment of rural residents. Specifically, rural reconstruction improved the layout of rural areas, improved the level of village planning, and improved the design of rural residences.

## Remaining Issues

Three main issues in urban and rural housing reconstruction remain to be resolved. First, because of time pressures to provide housing to those in need, some rural and urban housing reconstruction did not take into account the hidden hazards of secondary disasters. Second, although both seismic fortification intensity and standards for housing reconstruction were greatly improved following the earthquake, how to bring the reinforced houses built in the 1990s up to current technical standards remains a problem. A third problem remaining is how to maintain sustainable development of quake-hit areas.

# Appendix:

## Questionnaire about Urban and Rural Housing Reconstruction after the Wenchuan Earthquake

1. Location

______________________________________________

2. Your house was involved in ________

   A. on-site reconstruction

   B. off-site reconstruction (noncentralized allocation district)

   C. off-site reconstruction (centralized allocation district)

3. Your house was ________

   A. newly built

   B. reinforced

   C. self-repaired

4. Government subsidy for housing reconstruction was ________

   A. timely

   B. not timely

   C. up to the regulated amount

   D. failing to conform to the regulation

5. Your housing reconstruction was done ________

   A. voluntarily

   B. involuntarily

   C. not sure

6. Your housing reconstruction was done _________

   A. with the professional guidance

   B. with the help of construction workers

   C. without any professional guidance

7. Your house was rebuilt ________

   A. according to recommended construction blueprint

   B. based on previous experience

8. The structure of your house is ________

   A. brick

   B. concrete

   C. brick and wood

9. Your housing condition is ________

   A. improved greatly

   B. improved

   C. same as before

   D. worse than before

10. The seismic safety of your house is ________

    A. improved greatly

    B. improved

    C. the same as before

    D. worse than before

11. Did you ever receive any relevant training? ________

    A. I received training in disaster prevention.

    B. I received training in building and construction.

    C. I never received any relevant training.

12. Do you have any problems with or suggestions about housing reconstruction? Please elaborate.

    A. Problems

    B. Suggestion

# PART FOUR

## Evaluation of Wenchuan Earthquake Postdisaster Reconstruction Efforts: Investigative Report on Public Service Facilities and Infrastructure Reconstruction

# Introduction

The devastating 8.0 magnitude earthquake that struck Wenchuan County in Sichuan Province in 2008 caused heavy casualties and property damage. In order to rebuild homes for people in the quake-hit area as quickly as possible, the Chinese government carried out a large-scale reconstruction project. Based on empirical analyses, this report aims to objectively describe one aspect of that project, the reconstruction of public service facilities and infrastructure, and to highlight experiences and lessons for other similar reconstruction projects in the future.

The report applies a variety of research methods, including field investigation, documentary analysis, and case study. It draws on information about over 10,000 public service facility systems and sets of infrastructure. It makes use of a large number of government documents and academic papers related to reconstruction in the wake of the Wenchuan Earthquake. It also draws on surveys administered jointly with research teams investigating other aspects of the reconstruction process, and on a survey administered specifically in carrying out this research.

This report describes the state of public service facilities and infrastructure before they were struck by the massive earthquake (chapter 1) and analyzes the plan for rehabilitation and reconstruction of public service facilities and infrastructure, specifically its basis and goals (chapter 2). It then considers in detail the progress of reconstruction, with attention to four reconstruction modes – the special fiscal fund for reconstruction, "twin assistance," build-operate-transfer (BOT), and social donation (chapter 3). The basic lessons of rehabilitation and reconstruction of public service facilities and infrastructure are then explored, along with some problems that have been identified (4). The report concludes by making some policy recommendations designed to solve those problems (chapter 5).

The data in this report come from the following planning documents: Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction (State Council, 2008), Specialized Plans for Infrastructure in Post-Wenchuan Earthquake Recovery and Reconstruction (State Council, 2008), and Specialized Plans for Public Service Facilities in Post-Wenchuan Earthquake Recovery and Reconstruction (State Council, 2008). Some statistics are from the 2008 *Sichuan Statistical Yearbook* (China Statistics Press, 2008); from the Sichuan, Shaanxi, and Gansu provincial finance departments; and from departments of project planning and fund management in disaster-hit counties.

# 1

# Public Service Facilities and Infrastructure before and after the Wenchuan Earthquake

## Before the Earthquake

Before the Wenchuan Earthquake, all 51 counties, county-level cities, and districts in the quake-hit area were equipped with basic public service facilities for their urban and rural residents. However, these facilities did not entirely meet people's needs, owing to their inadequate scale and imperfect function. Some schools and hospitals collapsed during the earthquake, resulting in heavy casualties and property damage and to some extent revealing their poor design and low quality.

Various types of infrastructure, such as road networks, railroad networks, energy resources, communications systems, and irrigation and drainage facilities, had been constructed in the quake-hit area before the Wenchuan Earthquake, laying a basic foundation for the area's social and economic development. But a large part of the quake-hit area (in Sichuan Province, Shaanxi Province, and Gansu Province) is very remote, with high mountains and few roads. Owing to the complex terrain, some parts of it lacked some infrastructure, such as telephone, roads, water, natural gas, and even electricity.

Excepting in cities with rapid economic development, like Chengdu, Deyang, and Mianyang, the public service facilities and infrastructure in the counties, towns, and districts within the 51 counties of the quake-hit area are poor relative to the provincial averages. In particular, the public service facilities and infrastructure in impoverished mountain areas and in areas that are home to some of China's ethnic minorities are far below the average provincial level.

It was therefore desirable not only to rehabilitate and restore public service facilities and infrastructure in the quake-hit area to their original level, but also to further improve them so they approached the average level in the province. In this way equalization of public service facilities and infrastructure would be brought about.

For Sichuan Province as a whole in 2007, the average spending for education for each person was Y 299.11; for medical care Y 99.13; for sports, entertainment, and media Y 24.22; and for social security and employment Y 271.09. Compare the figures for Aba Autonomous Prefecture, a poor region hit very hard by the earthquake, where spending for the above services was only Y 133.05, Y 53.86, Y 14.38, and Y 46.74, representing 44.48 percent, 54.33 percent, 17.24 percent, and 54.33 percent of the average level of the whole province. Although the average level of spending in Mianyang City is close to the provincial average, Beichuan County, a part of

Mianyang City, is below the provincial level and almost at the bottom of Mianyang City. Similarly, the average spending of transportation per person is Y 42.81 in Sichuan as a whole, while in Aba Autonomous Prefecture it is only Y 32.42. If we take the density of population of Aba into consideration, we can see that in this large area the costs for construction of transportation facilities are higher than average, and that the lower transportation spending in this area means much poorer transportation facilities. [1]

## After the Earthquake

The Wenchuan Earthquake caused heavy damage to public service facilities and infrastructure in the quake-hit areas. Because it occurred intensively at a shallow depth, buildings were destroyed by the energy released, and the loss of property was huge.

Over 40 million $m^2$ of housing collapsed and more than 500,000 public service facilities were destroyed within the quake-hit area; the direct economic loss of infrastructure amounted to Y 107.006 billion, with the loss of transportation infrastructure (including railroads and civil aviation facilities), communication infrastructure (including postal facilities), energy resources, and irrigation and drainage infrastructure amounting to Y 57.898 billion, Y 7.087 billion, Y 17.692 billion, and Y 24.329 billion respectively.

Table 1.1 gives an overview of the economic losses in public service facilities and infrastructure in the affected areas.

**Table 1.1 Overview of Economic Loss of Public Service Facilities and Infrastructure in the Quake-Hit Area**

| | Total in three provinces | Sichuan Province | | Gansu Province | | Shaanxi Province | |
|---|---|---|---|---|---|---|---|
| | Economic loss (hundred million yuan) | Economic loss (hundred million yuan) | Damage as share of total damage (percent) | Economic loss (hundred million yuan) | Damage as share of total damage (percent) | Economic loss (hundred million yuan) | Damage as share of total damage (percent) |
| Municipal public facilities | 439.48 | 424.80 | 96.66 | 12.00 | 2.73 | 2.68 | 0.61 |
| Transportation infrastructure | 873.88 | 764.38 | 87.47 | 92.63 | 10.6 | 16.87 | 1.93 |
| Irrigation and drainage and power infrastructure | 469.77 | 430.22 | 91.58 | 24.85 | 5.29 | 14.70 | 3.13 |
| Facilities for education system | 46.76 | 40.74 | 87.12 | 5.41 | 11.57 | 0.61 | 1.31 |

1 Sichuan Statistical Yearbook 2008 (Beijing: China Statistic Press), 2008.

Con.

| | Total in three provinces | Sichuan Province | | Gansu Province | | Shaanxi Province | |
|---|---|---|---|---|---|---|---|
| | Economic loss (hundred million yuan) | Economic loss (hundred million yuan) | Damage as share of total damage (percent) | Economic loss (hundred million yuan) | Damage as share of total damage (percent) | Economic loss (hundred million yuan) | Damage as share of total damage (percent) |
| Facilities for sanitation system | 17.34 | 15.89 | 91.64 | 0.96 | 5.54 | 0.49 | 2.82 |
| Facilities for culture system | 27.24 | 25.9 | 95.08 | 0.88 | 3.23 | 0.46 | 1.69 |
| Facilities for environmental protection system | 26.18 | 25.4 | 97.02 | 0.38 | 1.45 | 0.40 | 1.53 |
| Facilities for government authorities | 53.57 | 44.76 | 83.55 | 4.01 | 7.49 | 4.80 | 8.96 |
| Cultural heritage | 89.66 | 84.2 | 93.91 | 3.95 | 4.41 | 1.51 | 1.68 |

# 2

# Plans for Rehabilitation and Reconstruction of Public Service Facilities and Infrastructure

## Basic Principles

Several principles guided the planning for rehabilitation and reconstruction of public service facilities and infrastructure. They are described below.

**Science and local conditions as a basis for planning**

Plans for reconstruction of public service facilities and infrastructure were based on the evaluation of the disaster and the analysis of geographical conditions as well as the bearing capacity of the resources environment. The reconstruction work had to be scientifically based and systematically planned, and had to take into account local economic, social, cultural, and natural factors.

**Harmonious reconstruction under the principle of "people first"**

Planning emphasized the importance of putting people first by fully respecting people's opinions, making use of people's wisdom, and seeking to resolve basic problems related to the living situation in the quake-hit area. Planning also sought to reconstruct both "hard" facilities and "soft" services in order to lay a solid foundation for the establishment of a harmonious society in the quake-hit area.

**Classification and step-by-step reconstruction**

Each type of public service facility and infrastructure has its distinct features that dictated different approaches to reconstruction. The construction mode and schedule were determined based on these features and other relevant factors. Classification of the different types of public service facilities and infrastructure made it easier to plan and carry out a step-by-step process of rehabilitation and reconstruction.

**Refined standards and long-term development**

The plan rested on the principle that compulsory construction standards and construction standards for different industries must be strictly adhered to in order to enhance the seismic fortification standard and the quality of buildings, to absorb and adopt new technology and knowledge for long-term development, and to establish the safest, strongest, and most reliable public service facilities and infrastructure.

**Integration and innovation**

In planning for rehabilitation and reconstruction, the construction work was seen as an opportunity to encourage and promote resources sharing and integration in the fields of public services and infrastructure; sharing and integration would allow resources to be saved and used intensively. Meanwhile, a new system could be innovated during this process to realize the integration of the "blood transfusion" and "blood formation" approaches to reconstruction – that is, the economy could be developed both with outside assistance (blood transfusion) and by means of self-development (blood formation).

## Reconstruction Objectives

The main objective of reconstructing public service facilities was to complete the relevant tasks in three years to ensure that every person could enjoy basic public services that were equal to or better than those that existed before the earthquake, both in quantity and quality.

The main objective of rehabilitating and reconstructing infrastructure was to manage and coordinate projects, in particular roads, railroads, civil aviation facilities, communication, postal services, energy resources, and irrigation and drainage facilities, so that within three years, service level and capacity would reach or exceed those of previous infrastructure; this goal would permit achievement of development goals determined under the 11th five-year plan.

## Main Content

The reconstruction plan specifies 12 items of content for public service facilities and 4 items of content for infrastructure.

**Public Service Facilities**

(1) The main content of education reconstruction is to rehabilitate schools, kindergartens, and other relevant public service facilities.

(2) The main content of health care reconstruction is to rebuild health care institutions and simultaneously improve staff, strengthen skills training, reform management systems, develop innovative mechanisms to improve medical care, and carry out of financial subsidy policies.

(3) The main content of family-planning reconstruction is to rebuild and reinforce relevant offices and provide them with equipment and mobile service vehicles.

(4) The main content of cultural reconstruction is to rebuild those public facilities such as libraries, cultural centers, theaters, and township integrated cultural stations; to reconstruct network engineering services for cultural resources and information sharing; and to protect and rehabilitate intangible cultural heritage.

(5) The main content of the reconstruction of cultural relics protection is to protect and restore all types of protected historic sites (including world heritages) at different levels within the planning range, and to maintain, reinforce, and reconstruct the damaged libraries, regional central stores of cultural relics, and cultural relic administrations and office buildings for protecting and displaying cultural relics within the planning range.

(6) The main content of news publication reconstruction is to reconstruct such public service infrastructure as farmers' reading rooms, bookstores in centralized sites, and branches of Xinhua Bookstore, which are responsible for issuing books at the grassroots level, and to restore the production and operation conditions for the development of the local news publication industry, the administration of news publication, and facilities and functions for eliminating pornography and illegal publications.

(7) The main content of broadcasting and film reconstruction is to rehabilitate and reconstruct the cable network and its distribution network for users within the urban-rural integration, and to rehabilitate and reconstruct such infrastructure

as radio stations, television stations, wireless transmitting and monitoring stations for radio and television, cinemas, and township broadcasting stations.

(8) The main content of physical culture reconstruction is to rebuild sports facilities such as gymnasiums, other places for physical exercise for the general public, and training grounds for amateur athletes.

(9) The main content of social welfare reconstruction is to rebuild equipment and facilities for civil and public services such as social welfare institutions, old-age homes, and homeless shelters.

(10) The main content of employment and social security reconstruction is to reconstruct employment and social security integrated service centers, grassroots labor security platforms, labor security firms, and similar public service infrastructure.

(11) The main content of grassroots government authority reconstruction is to reconstruct Communist Party and government organization offices and infrastructure for use by the political system, legal system, and armed forces.

(12) The main content of miscellaneous reconstruction is to rebuild some other public service facilities, including Chengdu Rehabilitation Center for the disabled, service facilities for the disabled at different levels, and facilities for youth activities.

**Infrastructure**

(1) The main content of traffic engineering reconstruction is to reconstruct such infrastructure as roads (highways and arterial highways), railroads, and civil aviation facilities.

(2) The main content of communication engineering reconstruction is to rehabilitate communications and postal facilities.

(3) The main content of energy resources engineering reconstruction is to reconstruct power grids and energy facilities for power, coal, oil, and natural gas use.

(4) The main content of hydraulic engineering reconstruction is to reconstruct the infrastructure for flood protection, irrigation and drainage, and water monitoring uses.

# 3

# Progress of Public Service Facility and Infrastructure Rehabilitation and Reconstruction

This chapter describes and analyzes the security measures undertaken for rehabilitation and reconstruction of public service facilities and infrastructure, explains the four different reconstruction modes, and looks at some of the accomplishments of the reconstruction work.

## Security Measures

### Security of the policy system

Both central and local governments attached great importance to the rehabilitation and reconstruction work in the aftermath of the Wenchuan Earthquake. They understood that public services and infrastructure rehabilitation and reconstruction affect people's livelihoods and are also the foundation for the recovery of industries. In order to ensure the implementation of the postdisaster rehabilitation and reconstruction work, central and local governments issued a series of policies and measures to form an integrated policy security system.

*Fiscal and tax policies*

The following fiscal and tax policies guided the reconstruction work:

Postdisaster reconstruction funds were to be established at both the central and provincial levels. The funding required for the central postdisaster reconstruction fund was to come mainly from the central government's general budget revenue, with partial budget revenue also from the central state-owned capital operation, special revenue from taxes on vehicle purchases, the central public welfare fund from the lottery, and compensation fees for newly used construction land. Governments in the quake-hit area (especially in Sichuan Province) were to set up comparable postdisaster reconstruction funds based on the experience of central finance.

The investment within government budgets at different levels was to be arranged. In principle, central finance and finance in the quake-hit area were proportionally to bear the cost of work on public service facilities for education, sanitation, and grassroots government authority uses, with reconstruction work related to central government departments (including institutions) directly borne by central finance. Funds from the "twin assistance" project and from social donations (that is, charitable contributions) were to be preferentially applied to the reconstruction of public service facilities for education and sanitation uses. As for transportation infrastructure rehabilitation and reconstruction, central finance was to provide project investment subsidies and discount loans; the fund required for constructing roads (including damaged national and provincial roads, bridges, culverts, and county roads) was to be mainly from the allocation and arrangement of the special revenue from tax on vehicle purchases, supplemented by general budget revenue from the central government. Apart from offering investment subsidies for the reinforcement of dangerous reservoirs, central finance was also to provide proper financial support to other irrigation and drainage facilities in the worst-hit area.

In order to speed up the process of the postdisaster reconstruction work, the government of Sichuan Province was to support the construction of major projects, preferentially start the emergency project, and make arrangements in advance for the construction of those public service facilities and infrastructure closely related to the living and working situation of people in the quake-hit area, both by integrating basic construction investment of departments directly under the province and by coordinating and adjusting basic construction investment and structures at provincial, municipal (state), and county (county-level city and district) levels according to the plan for postdisaster rehabilitation and reconstruction.

The fund controlled by the government was to be set up and preferential policies established for administrative fees. In order to speed up the process of postdisaster reconstruction work on infrastructure, enterprises engaged in mineral resource exploitation were to be exempted from paying mineral resources compensation fees and prospecting and mining rights royalties, as well as registration fees for petroleum (natural gas) exploration and exploitation, mining, and mineral resources exploration (which are all parts of the central revenue); utilities were exempt from paying power regulatory fees. In addition, as approved by the provincial government, the property tax on damaged houses and lands, urban real estate tax, and urban land use tax were waived through the end of 2008.

*Financial policies*

The following financial policies guided the reconstruction work:

Credit was to be strengthened to support the quake-hit area. The People's Bank of China Chengdu branch was to increase the reloan limit of some projects and authorize relevant municipal (state) units to further extend the newly increased limit to its counties (county-level cities) according to local conditions. Apart from newly increasing the reloan limit for small and medium-size financial institutions in Chengdu, Mianyang, Deyang, and Ya'an, the People's Bank of China Chengdu branch was also to support city commercial banks in the worst-hit areas in strengthening their credit aid for small and medium-size enterprises. At the same time, the Sichuan provincial government was to expand the credit approval authority of the subsidiary banks (at municipal and state levels) and of the branches directly under provincial ones.

Innovative financing methods were to be encouraged in order to support public services and infrastructure rehabilitation and reconstruction. Financial institutions were to strengthen their support by issuing asset securitization products, whose stable income would be used for transportation and water resources. Depending on specific needs, Sichuan Province was to issue some special credit products to serve as loans for production and operation capacity rehabilitation, home and housing project reconstruction, and infrastructure project implementation.

*Employment aid policies*

The following employment aid policies

guided the reconstruction work:

The range of employment aid was to be continually enlarged. People designated by the provincial government as having difficulty in finding employment after the earthquake were to be offered employment aid as stipulated, in order to ensure that at least one member of "zero-employment" families in the quake-hit area was employed. The Sichuan provincial government was to organize free vocational training and to conduct free orientation and other training for both urban and rural workers seeking employment. It was also to offer free vocational skills appraisal for certain categories of jobs intended to increase employment access.

Some jobs that included a public welfare subsidy were to be created. Both jobs related to earthquake relief and those held by local people who had difficulty finding employment were to be included in the defined range of existing and new positions that came with public welfare for three month. The position and social insurance subsidies as stipulated were also to be offered to those people involved in public welfare work who had difficulty in finding employment. Additionally, the local people who had suffered in the Wenchuan Earthquake were to be preferentially employed to do the work of rehabilitating the production of enterprises and constructing infrastructure in the quake-hit areas. Offering these local people jobs was considered preferable than offering outright grants.

A preferential tax policy was to be used to promote employment. After being identified by the labor security department at the county level, enterprises in the worst-hit areas that employed local urban workers who lost jobs because of the earthquake were to be given tax breaks – that is, depending on the number of workers hired, they were to take deductions from the business tax, city maintenance and construction tax, education surtax, and enterprise income tax. Self-employed workers in the worst-hit urban areas who are out of work because of the earthquake were also to be given tax breaks; they were to deduct a maximum of ￥8,000 from the business tax, city maintenance and construction tax, education surtax, and individual income tax. In addition, central finance was to disburse the funds required for implementing employment assistance in the quake-hit area from the special fund for employment as stipulated.

*Social insurance policies*

The following social insurance policies guided the reconstruction work:

Payment of employment injury insurance benefits was to be made increasingly secure, in response to the failure of the employment injury insurance fund in the quake-hit area of Sichuan to make full payments. For injured or dead policy holders, relevant benefits were to be paid as stipulated on the basis of verifying the casualty, the disability grade, and the specific standards of benefits. Any insufficiency in funds was to be made up by the national social security fund; this fund was to be financed at the municipal or provincial level in the local area, or else any balance from previous years was to be used. The injured or dead who were not policy holders were to receive benefits from the enterprises (units) for which they worked. Workers whose enterprises (units) failed to pay or no longer existed were to be helped through the relevant social donation and social assistance system as long as they were eligible for such assistance.

Payment of pension insurance benefits was to be made increasingly secure. Workers who were employed by enterprises that suffered in the earthquake and who would legally retire within five years were able to apply for internal retirement and enjoy corresponding pension insurance benefits after reaching the age for retirement, as stipulated in Regulations on the Placement of Surplus Workers and Staff of State-Owned Enterprises (Decree No. 111 of the State Council of China). Enterprises that stopped production after the earthquake were to be allowed to postpone the payment of social security fees; outstanding pension insurance fees of enterprises that declared bankruptcy because of the earthquake were to be cleared using bankruptcy assets according to relevant national regulations, with the insufficient part of fees canceled after approval as stipulated.

The basic livelihood of people who suffered in the earthquake was to be made increasingly secure. Unemployed people in the quake-hit area who qualified under Regulations on Unemployment Insurance (Decree No. 258 of the State Council of China) were to be paid adequate unemployment insurance benefits in a timely manner; urban residents who qualified for subsistence allowances were to be included within the range of urban subsistence allowances and to enjoy the benefits as stipulated; and people eligible for temporary living allowances were to receive such temporary living allowances as stipulated.

**Security of funding and technical assistance**

Various methods were to be used in securing funds and technical assistance for reconstruction of public service facilities and infrastructure.

*Security of funding*

Required funds were to be raised from the central financial fund, bank loans, local self-financing, the twin assistance project at provincial and municipal levels, social donations, and the fund self-financed by enterprises. The central government's investment was to be arranged from the specific postdisaster reconstruction fund, while the local investment was to be arranged from the local financial fund.

The Sichuan provincial government was to come up with financial resources for reconstruction by cutting its general expenditures, moving the reserve fund and the fund for budget adjustment at the provincial level, transferring the extrabudgetary fund, and arranging the public welfare fund from the lottery. Meanwhile, it was to devise methods for raising funds such as establishing a platform for government financing and investment, offering government-funded interest discounting, and relying on a BOT financing mode to lead banks and private capital to invest in postdisaster rehabilitation and reconstruction. Adhering to the principle of putting the livelihood of people first, the Shaanxi provincial government was to preferentially arrange the reconstruction of facilities for education, sanitation, and other public service uses, with the fund for public services mainly from the central fund and the reconstruction fund aided by other provincial governments.

In addition to fund-raising, fund management was also to be used to secure the effective application of funds. Governments at different levels were to focus on strengthening the management of reconstruction funds as follows: First, they were to compile an annual investment plan based on scientific and orderly implementation of the preliminary project work of rehabilitating and reconstructing facilities for government authority use. Second, after receiving the central fund, financial departments at different levels were to promptly appropriate enough funding to carry out the plan. Third, local governments were to establish relevant managerial systems specifically for use with the special funds and special accounts so as to ensure that funds were used properly. Fourth, financial departments at different levels were to emphasize supervision of reconstruction funds and successively formulate a series of rules and regulations for all districts, departments, and units to govern each step, including raising, allocating, appropriating, and using the funds.

*Security of technical assistance*

In addition to funding, trained technicians were understood to be necessary for solving engineering and technical problems in the process of rehabilitating and reconstructing public service facilities and infrastructure.

The training of technical personnel was to be strengthened. Personnel and labor security departments at different levels were to establish the mechanism for twin assistance and make use of qualified personnel under the program, make a special assistance plan to provide personnel support, consider personnel demand in advance, arrange personnel projects synchronously, and offer personnel services for the whole process of postdisaster rehabilitation and reconstruction. They were to actively organize professional technicians in the fields of education, sanitation, science and technology, agriculture, and culture to offer aid in the quake-hit area as part of twin assistance; they were to assign experts by stages and in groups to carry out activities for technical consultation and services in the quake-hit area, in order to help resolve engineering and technical problems demanding prompt solution; they were to adopt various methods to train groups of civil servants, professional technicians, and skilled personnel and practitioners in rural areas; and they were to help establish a unified public service institution to offer human resources services, facilities for personnel test use, and schools for training technical workers.

Personnel departments at different levels were to actively organize experts to go to the quake-hit area to offer consultation and guidance, technology development, project cooperation, personnel training, and other services, depending on the requirements of major projects and important professional and technical subjects. They were also to actively recruit foreign students to go to the quake-hit area for intellectual serves activities, with the strong guarantee of funds. Human resources and social security departments were to provide favorable policies in the quake-hit area regarding subsidies for postdoctoral research centers and projects, work station sites, and projects for foreign students. People whose earthquake relief work was outstanding were to be preferentially considered in the granting of professional titles. For those unable to take professional title examinations and evaluations because of their earthquake relief work, these departments were to promptly adjust the time of exams and otherwise safeguard candidates' legitimate rights and interests.

Relevant standards, guidelines, and specifications for construction were to be issued. The Ministry of Communications issued the Technical Guide for Road Rehabilitation and Reconstruction in the Aftermath of the Wenchuan Earthquake to explain the principles underlying the road rehabilitation and reconstruction project, to set out seismic fortification standards and technical requirements, and to explain how to conduct evaluation and measurement of damaged roads. The Ministry of Education distributed the Design Guidelines for Building Reconstruction Planned in Schools in the Aftermath of the Wenchuan Earthquake, which called for postdisaster reconstruction planning and construction of schools to comply with the guidelines apart from strictly implementing the relevant national engineering construction standard. The National Energy Administration issued the Guidelines for Power Grid Rehabilitation and Reconstruction in the Wenchuan Earthquake-Stricken Area to put forward the principles and standards for the rehabilitation and reconstruction of power grids.

The standards of the postdisaster rehabilitation and reconstruction project were to be strictly implemented in planning, site selection, design, bidding, supervision of construction quality, safety management, and construction progress. Some systems – including the project contract system, the system designating legal responsibility, the project supervision system, and the bidding system, as well as the subproject systems for construction, safety, and quality supervision – were to be established and improved to ensure standardized management and high quality.

**Security of the system and mechanism**

The process of postdisaster rehabilitation and reconstruction became an opportunity for the socialist system to create new systems and mechanisms, including twin assistance; to establish a government-driven reconstruction mechanism that encouraged the whole society's participation (seen in social involvement and investment and in the integration of the "blood transfusion" and "blood formation" approaches); and to receive extensive help from enterprises and individuals. In the regulations issued by the State Council on June 8, 2008, Regulations on Post-Wenchuan Earthquake Recovery and Reconstruction, the status and responsibilities of the government, society, and the people who suffered in the earthquake are clearly and legally defined: "The rehabilitation and reconstruction work should be led by the government with national support, while the people who suffered in the Wenchuan Earthquake should do relief and reconstruction work by themselves with the involvement and assistance of society." Both the twin assistance mechanism and the aid mechanism are defined as well.

The regulations describe the twin assistance mechanism as follows:

(1) Define assistance tasks. Twenty-four counties, county-level cities, and districts receive assistance from 19 assisting provinces and cities amounting to 1 percent of the assisting provinces' general budget revenue for the previous year.

(2) Encourage investment from all social circles. Enterprises, social communities, and individuals in all districts are encouraged to make investments to help establish factories and business infrastructure in the quake-hit area.

(3) Offer convenient conditions. Financial institutions are encouraged to provide preferential loans to enterprises involved in the twin assistance project. Rehabilitation and reconstruction of bulk cargo transportation facilities are preferentially included in the transportation plan for the railroad department, with a "green channel" (dedicated to transporting reconstruction supplies) developed by the road department.

The regulations describe the aid mechanisms as follows:

(1) Provide educational aid. Local schools in all districts are encouraged to recruit students from secondary vocational schools in the quake-hit area. Education policy of governments at different levels is required include compulsory education for accompanying children of migrant workers in the quake-hit area. The allocation and training of elementary and secondary school teachers, especially of special education teachers, must be improved, financial aid increased for students whose families have economic difficulties, and college and university admissions expanded.

(2) Implement relief work for the disabled. Construction of facilities for social welfare, social assistance, and rehabilitation uses is supported with the agreement that special facilities for the disabled should include public service facilities and enterprises. Social communities and individuals should be encouraged to provide assistance.

(3) Increase the range of employment aid. People who have had difficulty finding employment after the earthquake are included under employment aid to ensure that at least one of member in each

family is employed. Tax breaks are given to enterprises that employ local urban workers who lost jobs within the planning area because of the earthquake, and to self-employed urban workers out of work because of the earthquake. The rate of unemployment insurance offered by enterprises within the planning area is decreased as stipulated, while some measures, such as social security subsidies and small secured loans, are taken to promote employment.

(4) Strengthen poverty-relief aid. Subsistence allowances are offered to all rural residents who have had economic difficulty after the earthquake. The fund used for the rehabilitation and reconstruction of impoverished villages is arranged from the rehabilitation and reconstruction fund; the supporting funds provided by local governments for rehabilitation and reconstruction in the regions where ethnic minorities are resident and in impoverished areas are required to match the provincial level.

(5) Offer social security. Employment injury insurance policy holders are assured of receiving benefits, while others are helped though the relevant social donation and assistance system. Retired employees of enterprises in the quake-hit area are to be paid their pensions, while enterprises that have stopped their production after the earthquake may postpone the payment of social security fees. Outstanding pension insurance fees of bankrupt enterprises can be cleared by using bankruptcy assets, with the any unpaid fees being canceled after approval. Unemployment insurance benefits are fully paid on time with the provision of temporary living allowances and subsistence allowances for rural and urban residents.

(6) Offer legal aid. Legal aid institutions should offer services such as consultation, representation, and criminal defense free of charge according to law. Legal aid should receive necessary assistance from bar associations and should be monitored by justice and administration departments.

## Main Funding Modes

There were four main funding modes used in rehabilitating and reconstructing public service facilities and infrastructure: the special fund for reconstruction, twin assistance, build-operate-transfer, and social donation.

**Special fund for reconstruction mode**

In the aftermath of the Wenchuan Earthquake, central and provincial governments successively set up the fund for postdisaster rehabilitation and reconstruction; this became the major funding resource for the reconstruction planning project. The special fund was preferentially arranged to rehabilitate and reconstruct public service facilities and infrastructure.

Appropriations under the postdisaster reconstruction fund, both at the central and provincial levels, were based on a system of containing the total amount of funding and controlling it by classified standards; the object was to help local governments flexibly arrange the reconstruction project, simplify its process, and decide its schedule in advance. Under this system, municipal (state) governments and the county (county-level city) governments carrying out the pilot project of expanding authorities were responsible for making the overall arrangement of the approved plan for and implementation of rehabilitation and reconstruction within the limits of the investment plan. The amount of the central finance postdisaster reconstruction fund was adjusted among similar projects defined in both the general and special planning in different provinces without requiring reports to the Ministry of Finance or the National

Development and Reform Commission.

The budget-request and approval-issuance process worked as follows: Municipal (state) governments and the county (county-level city) governments responsible for the pilot project of expanding authorities, together with relevant provincial departments, controlled the amount of funding by classified standards according to the annual budget of the reconstruction fund issued by their provincial governments. They sent reconstruction fund application reports to their provincial department of finance, which then worked with the provincial Development and Reform Commission to examine and verify the reports, evaluate the amount in subsidies, and issue the fund budget as stipulated.

Financial departments at different levels were responsible for strong supervision and inspection of appropriations under and use of the reconstruction fund, and for appraising major projects and ensuring they followed relevant regulations.

The central fund played an irreplaceable role in securing the postdisaster reconstruction project in different provinces. For instance, it provided Y 220.343 billion for Sichuan province. By the end of September 2010, the central fund had issued all the relevant indicators; for public service facility and infrastructure reconstruction the fund could use up to Y 44.169 billion and Y 47.228 billion, respectively.

Public service facilities and infrastructure were significantly improved at both central and provincial levels under the security of the special fund. By the end of September 2011, 3,002 schools within the quake-hit area in Sichuan Province had been established, meaning that students living there could leave the movable plank houses (built out of boards or planks) that had been used as classrooms. By the same date, 2,032 health care institutions had been set up, with the successive completion of a group of social welfare institutes, old age homes, community service centers, and trade markets. In addition, the task of reconstructing backbone power grids and power grids in rural areas had been completed. Currently, a large number of major infrastructure projects intended to promote long-term development in the quake-hit area (reinforcement of damaged reservoirs, improved ecological restoration and environmental protection, and strengthened disaster prevention and mitigation capacity) are moving forward quickly.

**Twin assistance mode**

The twin assistance project of postdisaster reconstruction was the largest such project started by the central government. The project brought together not only a great deal of funding but also abundant material goods and managerial skill.

A month after the Wenchuan Earthquake, the central government decided to set up the twin assistance mechanism on the principle of "one province assists one worst-hit county." After approval by the State Council, 19 provinces and cities took responsibility for the project, which paired them with a specific region. First, officials in these 18 provinces and cities sent fact-finding groups to the quake-hit area and quickly made work plans to assist their "twin" region. The governments of Hong Kong SAR and Macao SAR promised to fully support the reconstruction work in Sichuan Province. The governments of Hainan Province and Inner Mongolia Autonomous Region also asked to jointly provide assistance to the reconstruction of Baoxin County and Dayi County, and although Chongqing municipality itself suffered damage in the earthquake, it provided twin assistance to the reconstruction of Chongzhou City in Sichuan Province. Thirteen cities in Sichuan Province that were not seriously affected conducted self-relief work and offered assistance to 13 damaged villages and towns in the worst-hit area.

Twin assistance was offered in two ways. The first involved turnkey projects. In these cases, those the donor province appropriated the construction fund and designed, prepared, constructed, and supervised the whole project, which was then transferred and used in the quake-hit area under local administration after final acceptance. The second involved "check transfer" projects. In these cases, the actual work was performed by the assisted area, while the donor province provided funding and supervision only.

Rebuilding in provinces and cities made construction work a normal part of governments' responsibility. To facilitate a smooth reconstruction process, governments issued a series of administrative regulations and devised work mechanisms. For example, Hebei Province established a rebuilding work team and office corresponding to Pingwu County's rebuilding work; it issued the Plan of Hebei Province's Supporting Work of Pingwu County's Postearthquake Recovery. Jilin Province issued the Plan for Support of Recovery and Reconstruction in Heishui County, Sichuan.

The donor provinces took a guiding role in planning and sought to lay a scientific foundation for assisted construction work. They relied on their own departments and local industries to draw up postdisaster reconstruction plans that included on-the-spot investigation, project research, and other forms of oversight. For example, officials from Shaanxi Province's transportation department, construction department, and development and reform department compiled the Mao County Implementation Plan of Recovery and Reconstruction, which addressed the situation of the Qiang People, and the Corresponding Rebuilding Plan for Mao County's Postdisaster Reconstruction Projects, which laid a solid foundation for the development of Mao County. Fujian Province issued Fujian Province's Corresponding Rebuilding Work Plan for Postdisaster Reconstruction Projects of Pengzhou City, as well as Detailed Rules of Reconstructing the Town of Longmen Mountain, the Construction Planning of Shengping Town's Permanent Resettlement Area, and tourism development plans for five seriously stricken towns (Longmen Mountain, White Deer, Danjing Mountain, Cifen, and Gexian Mountain) that offered good examples of reconstruction in disaster-stricken areas.

The donor provinces ensured the adequacy of rebuilding funds for ongoing projects and coordinated projects' implementation. For example, by adhering to the policy of "people's livelihood, public welfare, foundation, and function" and by carrying out careful investigations and evaluations, Shanghai scientifically arranged 112 key projects into four groups; the projects included residential housing, schools, hospitals, roads, sewage disposal, agricultural facilities, and employment and support for poor families, for a total amount of Y 8 billion.

Apart from providing material assistance, the donor provinces also provided needed expertise to the earthquake-stricken areas. In Chongqing, the education commission, human resource and social security bureau, health bureau, and financial office offered intellectual support and expertise to projects in Chongzhou County. Zhejiang Province carried out more than 10 special projects for intellectual assistance and thus helped Qingchuan County solve its unemployment problem. By training civil servants, teachers, and medical technicians, Liaoning Province helped Anxian County improve its public services. Shenzhen collected information on poor students in Longnan County and sent 14 teachers there and elsewhere to provide assistance to area teachers. The donor provinces sent 58 volunteer teachers to teach in Wenxian County and Kangxian County and 27 medical volunteers to train more than 10,000 primary school students in first aid in

Wenxian County. Twenty medical staff in two groups took temporary positions in medical care institutions in Longnan City.

The donor provinces focused throughout on sustainable development in the earthquake-stricken areas; they considered industrial reconstruction an especially important task. The industrial park in Beichuan County (assisted by Shandong Province) has already attracted 20 enterprises. Attracting social capital into industrial development was advantageous to both Tianjin and Shaanxi Province. With a planned construction area of 5 km2, the Ningqiang Circular Economy Industrial Park has attracted investment and industrial development; enterprises such as Baodi Corporation, Tianlishi Lily Intensive Processing Factory, and Qiangdi Food Company have located facilities there. The donor provinces stressed the recovery of local economies in the affected areas; they combined reconstruction with development and promoted the transformation of economic structure in earthquake-stricken areas with a goal of transforming the traditional agriculture counties into modernized counties based on tourism and industry.

**BOT infrastructure reconstruction mode**

Under the BOT (build-operate-transfer) mode, the government grants certain franchise rights to private enterprises (foreign enterprises included) through contracts to permit them to construct and operate specified public infrastructure through financing. These enterprises are also permitted to charge fees or sell products to customers to clear their loans, cover their investment, and make profits. When the franchise rights expire, the public infrastructure facilities that were built should be transferred to the government free of charge.

BOT showed itself a mode well suited to postearthquake reconstruction. BOT attracts funds that can reduce the pressure for financial investment. The BOT mode can also bring with it new technologies, including those that could increase earthquake resistance capacity and promote environmental protection. Moreover, the BOT mode allows an advanced funds-management approach that discourages corruption. Finally, the ownership of infrastructure facilities built under BOT reverts to the government after the agreement expires.

**Social donation mode**

Following the Wenchuan Earthquake, schools, hospitals, and charity houses were built with the donations of people from all sectors of the Chinese and international community. People who visited the earthquake-stricken areas reported that people had confidence that their homes would be rebuilt. Many enterprises and individuals – ordinary citizens, entrepreneurs, Chinese living abroad, foreign friends, the young and the old – donated money for housing reconstruction and helped to realize the dream of people who had lost homes in the earthquake. Not all donations were monetary; people also offered their sympathy and other forms of support.

## Reconstruction Progress in Sichuan, Shaanxi, and Gansu

**Reconstruction progress in Sichuan Province**

The tasks for reconstruction of public service facilities and infrastructure scheduled to occur over a three-year period were largely completed in two years. By September 30, 2011, 16,419 projects of recovery and reconstruction involving public service facilities and infrastructure had been started, accounting for 100 percent of the reconstruction tasks included in the plan (following the adjustment at mid-term). Y 232.907 billion had been invested, representing 97.97 percent of the total adjusted planned investment volume. Table 3.1 shows the progress in public service facility and infrastructure reconstruction in Sichuan through September 2011.

Table 3.1 **Progress in Public Service Facility and Infrastructure Reconstruction in Sichuan Province (as of end-September 2011)**

| Category | Projects | Plan | | Projects started | | Projects finished | |
|---|---|---|---|---|---|---|---|
| | | Number of projects | Investment (hundred million yuan) | Number of projects started | As percentage of total projects planned | Actual investment (hundred million yuan) | As percentage of total investment planned |
| Total | | 16,419 | 2,377.40 | 16,419 | 100 | 2,329.07 | 97.97 |
| Reconstruction of public service facilities | Total | 15,050 | 963.25 | 15,050 | 100 | 957.60 | 99.41 |
| | Education | 3,001 | 430.91 | 3,001 | 100 | 429.84 | 99.76 |
| | Medical care and public health | 2,032 | 137.33 | 2,032 | 100 | 137.29 | 99.96 |
| | Culture and sports | 4,081 | 95.77 | 4,081 | 100 | 81.05 | 84.63 |
| | Cultural relics | 579 | 52.67 | 579 | 100 | 42.75 | 81.16 |
| | Employment and social security | 4,536 | 80.32 | 4,536 | 100 | 80.09 | 99.71 |
| | Social management | 821 | 166.29 | 821 | 100 | 165.46 | 99.50 |
| Reconstruction of infrastructure | Total | 1,369 | 1,946.44 | 1,369 | 100 | 1,899.23 | 97.57 |
| | Transportation | 212 | 1,219.75 | 212 | 100 | 1,186.58 | 97.28 |
| | Postal communication | 6 | 168.29 | 6 | 100 | 168.29 | 100 |
| | Energy | 1,067 | 351.93 | 1,067 | 100 | 341.12 | 96.93 |
| | Water conservancy | 1,374 | 206.57 | 1,374 | 100 | 203.24 | 98.39 |

Source: Sichuan Province Department of Finance.

*Public service*

There were 15,050 public service projects undertaken in Sichuan, for a total investment of ¥95.760 billion, representing 100 percent of the total planned projects and 99.41 percent of the total planned investment.

(1) In education, building began on 3,001 schools; this was 100 percent of the tasks for reconstruction of schools. Of these, 2,978 schools were finished, representing 99.23 percent of the total planned. The volume invested was ¥42.984 billion, or 99.76 percent of the total planned volume.

(2) In medical care and public health, 2,032 projects were started; this was 100 percent of the planned tasks for reconstruction. Of these, 2,016 were finished, or 99.21 percent. The volume invested was ¥13.729 billion, or 99.96 percent of the volume planned.

(3) In facilities for culture and sports, 4,081 projects (including radio and television stations) were started; this was 100 percent of the planned projects. The total finished investment was ¥8.105 billion, or 84.63 percent of the total investment planned.

(4) In protection of cultural relics, 579

cultural heritage projects were started; this was 100 percent of the planned tasks. The total finished investment was Y 4. 275 billion, or 81. 16 percent of the planned investment.

(5) In employment and social security, 4, 536 projects were started; this was 100 percent of the planned tasks. Total finished investment was Y 8. 009 billion, or 99. 71 percent of the planned investment.

(6) In social management, 821 projects were started; this was 100 percent of the planned projects. Total finished investment was Y 16. 546 billion, or 99. 50 percent of the planned investment.

*Infrastructure*

There were 1, 369 infrastructure reconstruction projects started in Sichuan, representing 100 percent of the planned tasks. Y 189. 923 billion was invested, or 97. 57 percent of the total investment planned.

(1) In transportation, 212 projects were started; this was 100 percent of the tasks planned. The volume invested was Y 118. 658 billion, or 97. 28 percent of the volume planned. Among these projects were 11 highways; 85 national, provincial, and otherwise important roads; 24 bus terminals; 23 railway projects; 15 airport and civil aviation projects; and 49 rural roads.

(2) In postal communications, 6 projects were started and a total of Y 16. 829 billion invested, representing 100 percent of the planned investment.

(3) In energy, 1, 067 projects were started; they involved power sources, power supply, coal, and oil and gas and accounted for 100 percent of the total projects planned. Total investment was Y 34. 112 billion, or 96. 93 percent of the investment planned.

(4) In water conservancy, 84 projects were started, including reservoirs, dike reinforcement, elimination of threats from barrier lakes, and irrigation systems. This was 100 percent of the tasks planned. Most of the work on reservoirs damaged during the earthquake was finished. Repairs were finished on 28 of 29 barrier lakes. Thirty-nine water-supply projects in rural areas were started, solving the problem of access to drinking water for 6. 6868 million people, and Y 20. 324 billion was invested, or 98. 39 percent of the total investment planned. [1]

**Reconstruction progress in Shaanxi Province**

After the earthquake, Shaanxi Province started the reconstruction of public service facilities and infrastructure quickly, and the projects are now finished. As of September 30, 2011, 2, 354 projects of public service and infrastructure in Shaanxi Province were in operation, accounting for 100 percent of the reconstruction task. The volume of Y 6. 992 billion had been invested, or 96 percent of the total volume planned. Table 3. 2 shows the progress in public service facility and infrastructure reconstruction in Shaanxi Province through September 2011.

1 Data are from Sichuan Province Department of Finance.

**Table 3.2 Progress in Public Service Facility and Infrastructure Reconstruction in Shaanxi Province (as of end-September 2011)**

| Category | Projects | Plan | | Projects started | | Projects finished | |
|---|---|---|---|---|---|---|---|
| | | Number of projects | Investment (hundred million yuan) | Number of projects started | As percentage of total projects planned | Actual investment (hundred million yuan) | As percentage of total investment planned |
| Total | | 2,354 | 73.2 | 2,354 | 100 | 69.92 | 96 |
| Reconstruction of public service facilities | Total | 2,232 | 55.23 | 2,232 | 100 | 51.9 | 94 |
| | Education | 421 | 28.86 | 421 | 100 | 26.77 | 93 |
| | Medical care and public health | 732 | 8.45 | 732 | 100 | 8.65 | 102 |
| | Culture and sports | 48 | 3.87 | 48 | 100 | 3.79 | 98 |
| | Cultural relics | 17 | 1.20 | 17 | 100 | 1.28 | 106 |
| | Employment and social security | 123 | 5.63 | 123 | 100 | 4.51 | 80 |
| | Social administration | 891 | 7.22 | 891 | 100 | 6.90 | 96 |
| Reconstruction of infrastructure | Total | 122 | 17.97 | 122 | 100 | 18.02 | 100 |
| | Transportation | 10 | 15.17 | 10 | 100 | 15.2 | 100 |
| | Energy | 29 | 0.69 | 29 | 100 | 0.70 | 101 |
| | Water conservancy | 83 | 2.11 | 83 | 100 | 2.12 | 101 |

Source: Shaanxi Province Department of Finance.

*Public service*

Of 2,232 public service projects in Shaanxi Province, 100 percent are in operation; Y 5.19 billion, 94 percent of the total volume planned, was invested.

(1) In education, 421 schools, or 100 percent of the number planned, were completed; 93 percent of planned investment, or RMB 2.677 billion, was used.

(2) In the medical field, 732 medical and public health projects, or 100 percent of planned number, were completed; Y 865 million, or 102 percent of the volume planned, was invested.

(3) In culture and sports, 48 cultural and sports projects (including radio and cable) were completed, or 100 percent of those planned. Investment was Y 379 million, or 98 percent of the volume planned.

(4) In preservation of cultural relics, 17 projects were completed, or 100 percent of the planned number. Investment was Y 128 million, or 106 percent of the volume planned.

(5) In employment and social security, 123 projects, or 100 percent of those planned, were completed. Investment was Y 451 million, or 80 percent of the volume planned.

(6) In social administration, 891 projects, or 100 percent of those planned, were completed. Investment was Y 690 million, or 96 percent of the planned volume.

*Infrastructure*

All 122 infrastructure projects planned for Shaanxi were started; Y 1.802 billion, or 100 percent of the volume planned, was invested.

(1) In transportation, there were 10 projects undertaken or 100 percent of those planned; investment was Y 1.52 million, or 100 percent of planned investment volume.

(2) In energy, 29 projects were completed, or 100 percent of those planned; investment was Y 70 million, or 101 percent of total planned investment volume.

(3) In water conservancy, 83 projects were completed, or 100 percent of those planned; investment was Y 212 million, or 101 percent of the total investment planned.[2]

**Reconstruction progress in Gansu Province**

Gansu Province has basically finished its reconstruction tasks. By September 30, 2011, 5,258 public service facility and infrastructure projects in Gansu Province were in operation, or 100 percent of the reconstruction tasks. A volume of Y 21.958 billion had been invested, or 99.67 percent of the total volume planned. Table 3.3 shows progress in public service facility and infrastructure reconstruction in Gansu Province through September 2011.

**Table 3.3 Progress in Public Service Facility and Infrastructure Reconstruction in Gansu Province (as of end-September 2011)**

| Category | Projects | Plan | | Projects started | | Projects finished | |
|---|---|---|---|---|---|---|---|
| | | Number of projects | Investment (hundred million yuan) | Number of projects started | As percentage of total projects planned | Actual investment (hundred million yuan) | As percentage of total investment planned |
| Total | | 5,258 | 220.32 | 5,258 | 100 | 219.58 | 99.67 |
| Reconstruction of public service facilities | Total | 1,690 | 80.27 | 1,690 | 100 | 73.71 | 91.3 |
| | Education | 554 | 38.26 | 554 | 100 | 36.47 | 95.3 |
| | Medical care and public health | 232 | 15.75 | 232 | 100 | 15.27 | 97.0 |
| | Culture and sports | 222 | 7.72 | 222 | 100 | 4.94 | 63.9 |
| | Cultural relics | 35 | 1.06 | 35 | 100 | 0.84 | 78.6 |
| | Employment and social security | 200 | 2.66 | 200 | 100 | 2.14 | 80.3 |
| | Social administration | 447 | 14.82 | 447 | 100 | 13.67 | 92.3 |

1 Data are from Shaanxi Province Department of Finance.

Con.

| Category | Projects | Plan | | Projects started | | Projects finished | |
|---|---|---|---|---|---|---|---|
| | | Number of projects | Investment (hundred million yuan) | Number of projects started | As percentage of total projects planned | Actual investment (hundred million yuan) | As percentage of total investment planned |
| Reconstruction of infrastructure | Total | 3, 568 | 140. 05 | 3, 568 | 100 | 145. 87 | 104. 2 |
| | Transportation | 2, 613 | 104. 54 | 2, 613 | 100 | 110. 40 | 105. 6 |
| | Postal communication | 305 | 18. 09 | 305 | 100 | 18. 09 | 100. 0 |
| | Energy | 190 | 11. 04 | 190 | 100 | 11. 04 | 100. 0 |
| | Water conservancy | 460 | 6. 37 | 460 | 100 | 6. 34 | 99. 5 |

Source: Gansu Province Department of Finance.

*Public service*

All of the 1, 690 public service facility projects planned for Gansu are now in operation; 91. 3 percent of total planned investment, or Y 7. 371 billion, was used.

(1) In education, 554 schools, or 100 percent of the number planned, were under construction; 95. 3 percent of planned investment, or Y 3. 647 billion, was used.

(2) In the field of medical care and public health, 100 percent of the 232 planned projects were started, and 97 percent of the planned investment volume of Y 1. 527 billion was used.

(3) In culture and sports, 222 projects, including radio and cable, were started, accounting for 100 percent of projects planned. A volume of Y 494 million, or 63. 9 percent of the planned volume, was invested.

(4) In preservation of cultural relics, 35 projects had been started, accounting for 100 percent of the planned number. A volume of Y 84 million was invested, or 78. 6 percent of the planned volume.

(5) In employment and social security, 200 projects, or 100 percent of those planned, had been started. A volume of Y 214 million, or 80. 3 percent of the planned volume, had been invested.

(6) In social administration, 891 projects, or 100 percent of those planned, were started; a volume of Y 1. 367 billion, or 92. 3 percent of the planned volume, was invested.

*Infrastructure*

All the 3, 568 infrastructure projects planned for Gansu were started, and Y 14. 587 billion, or 100 percent of the planned volume, was invested.

(1) In transportation, all the 2, 613 projects planned were completed, and Y 11. 04 billion, or 105. 6 percent of the planned volume, was invested.

(2) In postal communications, all 305 planned projects were completed; a volume of Y 1. 809 billion, or 100 percent of the planned volume, was invested.

(3) In energy, all 190 planned projects were completed; a volume of Y 1. 104 billion, or 100 percent of the planned volume, was invested.

(4) In water conservancy, all 460 projects were completed; a volume of Y 634 million, or 99.5 percent of the planned volume, was invested. [3]

## Reconstruction Achievements

The reconstruction project generally finished three years of tasks within two years. Public service facilities and infrastructure reconstruction were given priority in funding and have achieved remarkable results.

Civil projects like schools, medical facilities, and public health institutions were the fastest-constructed projects and pushed development forward precipitously. In Sichuan Province, over 3,000 schools have been basically finished, and all of the students in the earthquake-stricken areas have moved out of the temporary classrooms. Over 2,000 medical care facilities and public health institutions have basically been finished. Many civil facilities, such as charity houses, homes for the aged, community service centers, and markets have been put into use, which better allows the earthquake-stricken areas to safeguard people's well-being and to help vulnerable groups such as the unemployed, poor, orphans, and the disabled. In the period from May 12, 2008, through the end of September 2010 (that is, during the most arduous period of the reconstruction work), the areas affected by the earthquake had no famine, no displaced persons, no massive epidemic, and no instability; these conditions facilitated the postearthquake reconstruction.

Many major infrastructure projects that are important to the long-term development of the earthquake-stricken areas were accelerated in construction. The backbone power network of Sichuan Province and the rural electricity network reconstruction have been basically finished. The reinforcement of damaged reservoirs is progressing smoothly. More measures are being taken to repair the ecological system and protect the environment, which in turn increases the ability to prevent or reduce disasters. There is an entirely new look to the urban and rural areas, where towns and villages are laid out rationally; the transportation system and housing conditions have both been improved. A group of modern new towns has been built, including 38 key towns in reconstruction. Model towns and villages – such as Shuimo Town in Wenchuan, Dacheng Village in Mianzhu, and Mazhumiao in Shifang – are equipped with convenient facilities and have distinctive characteristics. Now, in the earthquake-stricken areas, rural houses are the most beautiful buildings; schools are the most secure places; hospitals are the most modern institutions. The people are highly satisfied.

Postearthquake reconstruction funds were managed efficiently. By estimating each area's degree of damage, need for reconstruction, and financial status, Sichuan Province carefully calculated and allocated the volume of funds for each seriously stricken area. When arranging subsidies for special projects, the government established a standard covering the planned investment scale, the identification of government's power on the markets, as well as the responsibilities between the higher level and lower level government. In making its midterm adjustment, the government weighed the degree of urgency of the various projects to make sure that all the funds were available and that the projects could be started. With the help and administration of both the party committee at various levels and the Postearthquake Reconstruction Council, financial departments at all levels founded the Management Committee for Reconstruction Funds. One further reason why the manage-

3 Data are from Gansu Province Department of Finance.

ment of funds has been controlled, supervised, and evaluated is that counties and cities have been kept mindful of their obligations and encouraged to feel a sense of service.

Pengzhou People's Hospital offers a good example of the improvements associated with reconstruction. Before reconstruction, Pengzhou People's Hospital was the best-equipped hospital in Pengzhou, with various departments, enough sickbeds, and relatively advanced equipment. However, with the development of cities, there gradually came to be a gap between the needs of the people and the hospitals' available equipment and services. After reconstruction, the hospital equipment was updated and the staff taught new management and medical skills from the donor provinces. The hospital can now satisfy the needs of Pengzhou residents. Table 3.4 compares Pengzhou People's Hospital before and after the reconstruction.

**Table 3.4 Pengzhou People's Hospital before and after Reconstruction**

| | Before reconstruction | After reconstruction |
|---|---|---|
| Floor area | 37,000 $m^2$ | 84,042 $m^2$ |
| Building area | 51,000 $m^2$ | 48,000 $m^2$ |
| Beds available | 303 | 680 |
| Departments | 12 level-1 departments, 17 level-2 professional departments | Various professional departments and emergency department; 6 departments of internal medicine (cardiology, neurology, respiratory, gastroenterology, nephrology, oncology); 5 surgical departments (neurosurgery, urology, general surgery, orthopedic, thoracic); individual VIP section, ENT department, hemodialysis room, ICU |
| Major medical equipment | Japanese Lightspeed VCT, automatic biochemical instrument, CLIA instrument, ESWL equipment, and pathological graphics system | Standard operating room, nuclear magnetic resonance system, 64-layered Lightspeed VCT, DSIM, DSA, color Doppler ultrasound, endoscope, and other advanced medical equipment |

Source: Pengzhou Finance Bureau.

Note: VCT = video contrast tracker; CLIA = chemiluminescence immunoassay; ESWL = extracorporeal shock wave lithotripsy; DSIM = data set information map; DSA = digital subtraction angiography.

The security and safety of public service facilities have also been greatly improved in reconstruction. Buildings have been designed to withstand earthquakes, high-quality building materials have been used, and security facilities have been added for possible need in the future to ensure public safety.

Yongchang Middle School in Beichuan County is a good example of these types of improvements. The school's design strictly follows the standard of VIII (8) degrees of seismic fortification and IX (9) degrees of seismic resistance. Corridors have been built to join the main building and auxiliary buildings, a design that enhances earthquake resistance, and reinforcing steel bars (level 1HRB400, 855 ton) are present, which improves the seismic fortification degree. The building was also designed and treated to resist corrosion and fire and has an automatic fire alarm system, lightening protection, and an electrical grounding system. It uses a new type of wall material and is designed to be accessible for people with disabilities. Several safety shelters have also been built on the campus, and classrooms have been equipped to teach a "life course" that meets twice a week and covers such topics as common-sense safety practices in the outdoors, fire fighting, and first aid. The classroom is equipped with cable access, a first-aid model, and fire-fighting equipment. The school also holds regular earthquake and fire drills for students (see figure 3. 1).


**Figure 3. 1 Life Course Classroom (Yongchang Middle School, Beichuan County)**

Source: Finance Bureau of Beichuan County.

# 4

# Reconstruction Lessons and Problems

Reconstruction following the Wenchuan Earthquake, especially of public services and infrastructure, was a significant achievement. In the course of reconstruction, some valuable lessons were learned and some remaining problems identified.

## Lessons in Reconstruction of Public Service Facilities and Infrastructure

**Prompt central planning**

After the earthquake, a team of officials from the central and local governments drew on scientific investigation and practical disaster-relief experiences from abroad to devise a plan for reconstruction of public service facilities and infrastructure. On September 27, 2008, the central government issued the Plan for Post-Wenchuan Earthquake Reconstruction of Public Service Facilities, and on October 17, 2008, it issued the Plan for Post-Wenchuan Earthquake Reconstruction of Infrastructure. Within overall reconstruction planning, reconstruction of public service facilities and infrastructure was made a priority to ensure it would be carried out quickly.

The planning for reconstruction of public service facilities and infrastructure included 14 categories, among them summaries of the situation, guidance and basic principles, targets and implementation stages, schedule, and investment estimates. In 2009, based on the summary of the early stages of the work, relevant departments in the State Council made some adjustments and corrections to the plan so that work could proceed more rationally and effectively. A well-made plan can establish clear accountability and responsibilities and ensure that funding is available in full. The unified plan made by the central government, which made use of comparative advantages and was supported by the whole country, greatly contributed to the success of reconstruction.

**High-speed, high-efficiency implementation**

Following the plan, the earthquake-stricken provinces quickly began to address the implementation regulations. The schedule for completion of reconstruction work was eventually changed and the work speeded up as vital measures and accountability were strengthened. To ensure the scientific basis for and effective implementation of the plan, great attention was paid to policy consistency, and efforts were made to raise capital, promote and coordinate related projects, and emphasize key elements and safety.

At the early stage of disaster-relief work, the government initiated an array of projects to restore housing and vital infrastructure such as roads, hospitals, and water supply in earthquake-stricken areas. During the implementation of the project, public service facilities and infrastructure were a priority, and work on hospitals, schools, and rehabilitation agencies moved forward. The government spared no effort to build new roads and ensure the supply of water and electricity.

**Twin assistance mechanism**

To accelerate the postearthquake reconstruction, the central government established the twin assistance mechanism and made a unified plan to carry out the twin assistance projects. In accordance with the plan, the donor provinces and cities offered the disaster-stricken areas labor, material, funding, and technical support. Twin assistance support gave priority to projects that ensured basic living conditions for people affected by the disaster.

For instance, the Beijing-Shifang twin assistance project focused on the most seriously stricken farmhouses, schools, and badly needed public service facilities and infrastructure and managed to accelerate the approval process for reconstruction of 22 schools, 12 hospitals, 7 welfare centers, and 31 infrastructure projects. Among the 18 twin assistance projects, the Huan-Lixian project was the first to initiate the rural safe drinking water and farmland irrigation work, with investment of Y 50 million. A total of Y 500 million was distributed among more than 30 livelihood projects, such as rebuilding of houses, schools, hospitals, and roads, to help people resume normal living and working as soon as possible.

The twin assistance project was an important mode of postearthquake reconstruction that arguably embodies the strengths of a socialist government and society. It yielded valuable experiences that could provide practical guidance for future postdisaster reconstruction work in similar cases.

**Scientific organization and realistic and pragmatic approach**

To implement the reconstruction work effectively and smoothly, the governments of disaster-stricken provinces organized experts to investigate conditions, discuss findings, and formulate pragmatic measures and plans. Those plans took into consideration the bearing capacity of the environment and potential threats, so that reconstruction could proceed with functions clearly defined and layouts optimized. For instance, in accordance with Sichuan Province's geography and economy, the reconstruction work there adopted three modes: off-site reconstruction with full functions (that is, with infrastructure, public service facilities, and industry operating and secure), on-site reconstruction with full functions, and on-site reconstruction with weak functions (that is, with infrastructure and so on limited by the environment, and resource protection issues present.)

In keeping with the concept of scientific development, the Zhejiang-Qingchuan twin assistance project produced a regional development plan for the whole area, with focus on targeted items such as education, transportation, and water supply. The plan involved geographic surveys and mapping as well as geological disaster assessment to ensure the accuracy of the plan. Drawing on those pragmatic investigations, the plan also incorporated Qingchuan County's comprehensive development program.

## Problems in Reconstruction of Public Service Facilities and Infrastructure

After more than two years of effort, postearthquake reconstruction had accomplished a great deal. The disaster-stricken areas had almost restored basic working and living conditions. However, significant work remains, and obstacles will need to be overcome in order to promote desired development in and revitalize the economy of disaster-stricken areas.

**Lack of internal dynamic development**

The restoration and development of public service facilities in disaster-stricken areas was mainly due to external reconstruction investment, preferential policy, and twin assistance. Therefore, lack of internal dynamic development, weak risk resistance, and an unstable development foundation are problems still in need of solutions. More specifically, the public service facilities in some areas are still functioning at a low level; the financial debt pressure of counties is heavy; the adjustment of economic structure is slow; and the transformation of economic development still has a long way to go. Solving these problems and promoting public services, especially in the boundary areas of counties, remain the great challenges of reconstruction.

In their effort to bridge gaps in reconstruction capital, moreover, earthquake-stricken counties now suffer from financial deficits in varying degrees. With reconstruction projects completed and with capital investments – once was the main source of revenue – decreasing, counties are having to increase expenditures to cover implementation of various social insurance programs (for example, Primary and Secondary Public Expenditure Standard, Basic Public Health Service Standard, Essential Medical System and Extension Coverage of New Social Security System for Rural Areas). Thus the financial deficits become even graver, and the sustainable development of the social economy becomes correspondingly difficult to realize.

**Burden of maintaining public service facilities after reconstruction**

With reconstruction projects mainly completed, the great challenge is to strengthen asset management, ensure the normal operation of public service facilities, and facilitate sound and fast social and economic development in disaster-affected areas.

According to the statistics, expenditures on the maintenance of education, medical, and other public service facilities have increased dramatically over prereconstruction expenditures. The management and maintenance of public service facilities lack not only sufficient capital support, but also professional technicians. In addition, there is a serious shortage of community services serving orphans, people with disabilities, and the elderly, putting a strain on facilities that do exist. Psychological counseling for people who suffered in the earthquake is also both necessary and in short supply. Properly resolving these issues, building up mutual-help social networks, and truly revitalizing the disaster-striven areas will require more time and effort.

**Unemployment and poverty**

The Wenchuan Earthquake not only caused huge loss of property, it resulted in a tremendous number of casualties. The loss of primary family earners and skilled technicians in particular poses a severe challenge to poverty alleviation and employment promotion in the affected area.

Of the 39 disaster-stricken counties in Sichuan Province, 31 counties are addressing the task of poverty alleviation and development, and 2,117 impoverished villages are suffering from the effects of the earthquake. There is a significant need to provide health care, to ensure school enrollment, and to find employment for families that lost the primary earner or are otherwise without income. Poor rural and urban households put a great deal of pressure on social security services and benefits and pose an overall challenge to the reconstruction of public service facilities; soft equipment for public service facilities is still a grave problem. To solve those problems, there need to be more enterprises involved, a better working environment, more-comprehensive technical training, and improvements to the management system.

### Reconstruction planning lapse

The plan for infrastructure reconstruction included construction of rural water-supply facilities in the targeted plan for rural construction, and included construction of rural hydroelectricity infrastructure construction in the targeted plan for energy infrastructure; the distribution of reconstruction capital from the central government was similarly structured. Neither of these two projects includes construction of water-conservancy facilities, nor is there a definite explanation of the capital to be used for water conservancy. Thus actions undertaken by the water-conservancy bureau and the agriculture and electricity departments risk disorganization and incoherence. Moreover, it becomes hard to ensure that the construction capital for the two projects can be paid in full.

# 5

# Policy Recommendations

The postdisaster reconstruction of public service facilities and infrastructure has been basically completed, but there is still a long way to go in subsequent management and operation. Taking the weak economic basis into consideration, the departments concerned with follow-up must determine relevant supportive policies, specify deadlines in dealing with emergencies, and improve the policies applicable to medium- and long-term plans. The deadlines for emergency supportive policies should be consistent with the time limitations imposed by the overall planning, but the duration should be appropriately extended to promote the rehabilitation of enterprise production, to lighten the burdens of farmers, to facilitate the reconstruction of the infrastructure, to encourage social donations, and to implement the preferential employment policies. In implementing the 12th five-year plan issued by stricken provinces and central departments, importance should be attached to long-term urban and rural development in seriously stricken areas, and to the restoration and reconstruction work uncompleted in moderately stricken districts.

Most of the public service facility projects were built by the supporting provinces and cities at the expense of the central government's rebuilding fund, which required a higher standard for both the building areas and the configuration of the facilities and equipment. The standards of the whole project have risen significantly. However, these high-standard large-scale projects come with soaring maintenance costs. The possibility of transfer payments therefore deserves significant attention and consideration by the central government as disaster-area governments adjust measures to local conditions and respond to these concerns on their own.

The following policy recommendations are intended to address the most pressing remaining issues of the reconstruction process.

## Deepen the Reform of the Budget System and Provide Funding for Public Facilities Maintenance

The budget should be managed at the beginning of the fiscal year in the following order: ensure that workers get paid promptly, guarantee that projects function normally, make certain that operations are maintained steadily, take on no more than abilities and finances allow, and lay a basic foundation for the relevant public service facilities' maintenance.

In addition, budgeting methods should be changed from the base- plus-increase mode to the zero-base budgeting mode. The outmoded methods of calculating the budget should be changed this year on the account of the expenditure last year. The revenue and expenditure of all government funds should be administered uniformly by a comprehensive budget system following these principles: standardization of personnel expenditures, quantification of public spending, and itemization of special funds. This change will rectify the lack of conformity within and without the budget.

Budget constraints should also be hardened. Once they are decided upon, no change should be made arbitrarily. Balancing between revenues and expenditures, and digesting the deficit and government debts that accumulate over the calendar year, will be achieved through the efforts made in scientific budgeting planning and powerful constraint.

### Hold Structural Expenditure Adjustments Constant and Raise Funds for Public Facilities Maintenance through Multiple Channels

To keep the adjusted expenditure structure constant, funds for public facilities maintenance can be raised though three channels.

The first channel is the financial increase. According to historical experience and preliminary estimates, seriously stricken counties generally run a surplus that grows every year, and this could be part of the financing for public service projects. Especially as concerns the incremental financial arrangement of cities and counties in 2011, the expenditure demand just mentioned should be taken into consideration.

The second channel is the expenditure stock. Notwithstanding the increase in expenditure for maintenance, stricken areas have been reshaped through reconstruction, and there will be a decreasing demand for development and construction. For this reason, part of the finance stock available for development should be reallocated for maintenance.

The third channel is the transfer payment assigned by general supervising entity. Because the central government and provincial governments will increase transfer payments, it is possible for the disaster-area governments to distribute this fund and use part of it to guarantee the operation and maintenance of public service projects.

In short, financial surplus, financial stock, and transfer payments are the three major sources of funding for maintenance expenditures. If these sources are used, people in affected areas will eventually get public service of high quality.

### Distinguish between Public Service Projects and Quasi-Public Service Projects, and Expand Some while Contracting Others

There should be differential treatment of public service projects to guarantee their operation according to the degree of public benefit they provide. For the pure commonweal projects, governments should assume responsibility for their maintenance; for the semipublic service projects, it is practicable that governments and relevant operating agencies share the cost; for those that are profitable, market-oriented operation should be available, and operating agencies should bear the cost. In general, government should hold on to the most worthwhile projects while also encouraging markets to assume operation of other projects through institutional reform and mechanism innovation. Specifically, governments must guarantee adequate supply of the pure commonweal projects, such as compulsory education, public health care, and social welfare; as for quasi-public service projects (those that could be handled in part through a market), governments could apply differential policies in order to encourage them to adapt to a market environment. Meanwhile, value should continue to be placed on a plain style of living, hard work, and strict economy.

### Raise Funds through Multiple Channels and Counterbalance Financing Gaps

The estimated total investment in infrastructure and public service facility reconstruction in the three seriously affected provinces is ¥ 992.576 billion, while the financial gap is as high as ¥ 200.133 billion, or 20.16 percent of the total investment. To address this issue, four steps should be taken: first, solve the problem of excessive reconstruction of some projects and modestly reduce the scale of overall investment; second, conduct comprehensive planning and arrangement for total capital; third, put some projects into effect as components of the national or local 12th five-year plan; fourth, where the financial gap is relatively serious (as in the severely afflicted area, such as Wenchuan County, Beichuan County, and Qingchuan County), central authorities should consider providing some financial support.

### Strengthen Communication between Governments and Departments at All Levels and Coordinate Different Plans

Because communication and coordination are ineffective, local deployments deviate from the central ministries' indications, and related tasks are divided into different plans; the result is that some projects are not completed on time or suffer a shortage of funds. Governments and departments at all levels should further enhance communication, clearly specify the construction plans and their corresponding distributions, and solve the problems of duplicated layout and omissions.

### Improve and Implement Preferential Policies for Taxes, Loans, and Land for Infrastructure

In order to expedite infrastructure construction, the state established a series of preferential policies concerning taxes, loans, and land. Under the circumstances, concerned departments should take steps to strengthen the implementation of these policies. It is also important to note that the land usage index for infrastructure needs to be guaranteed and the lands approved be put into operation first. Concerned departments could help to expedite the land acquisition procedures according to relevant regulations. Only by implementing these preferential policies can greater investment be attracted to contribute to infrastructure construction projects with a long cycle.

### Set Up an Emergency Financing Mechanism to Deal with Prevention and Control of Secondary Disasters

The problem of controlling geographical hazards in the earthquake-stricken areas remains a difficult one. Frequent secondary disasters create enormous pressure on infrastructure reconstruction. For instance, a debris flow and flash flood occurring in the summer of 2010 seriously damaged and resulted in losses to infrastructure reconstruction projects in Qingping Town of Mianzhu City, Yingxiu Town of Wenchuan City, and Hongkou and Longchi of Du Jiangyan City. An emergency financing mechanism should be set up to deal with the prevention and control of secondary disasters and provide financial and policy support for disaster prevention and reduction.

# PART FIVE

## Evaluation of Wenchuan Earthquake Postdisaster Reconstruction Efforts: Investigative Report on Industrial Recovery and Reconstruction

# Introduction

The devastating earthquake that struck Wenchuan County on May 12, 2008, caused tremendous damage to the economy in the disaster areas, 1 with heavy losses to primary industry, secondary industry, and tertiary industry. In order to restore the industrial economy in the earthquake- stricken areas in the shortest possible time, China's central government and local governments promptly formulated and implemented a series of plans, including the Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction, the Special Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction of Productive Forces Distribution and Industrial Restructuring, and the Special Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction of the Marketing Service System. The aim of the plans was to get industrial recovery and reconstruction underway quickly, to ensure that progress was steady and ordered, and to attract worldwide attention to the reconstruction process.

Supported financially by the World Bank, the China Ministry of Finance organized a follow-up investigation of the postearthquake industrial recovery and reconstruction. Its goal was to provide systematic, accurate, and up-to-date information about the industrial reconstruction process – about government action, about the progress and results of the work, and about the basic experiences and problems of reconstruction. The research findings were also meant to serve as a reference both for the next stage of industrial development and rejuvenation in the quake-stricken areas and for industrial recovery and reconstruction in other areas, domestic and foreign, that might suffer an earthquake in the future. Using field investigation, case study, quantitative analysis, and other methods, and drawing on statistical socioeconomic sources provided by relevant government departments, researchers compiled a full investigative report on industrial recovery and reconstruction as well as the current summary version.

The current report includes five chapters. The first chapter describes industrial development before the earthquake and the damage caused by the earthquake. The second chapter describes the content, the guiding ideology, and the main goals and tasks of the plan for industrial economic recovery and reconstruction in the affected areas. The third chapter describes the industrial economic recovery process, including the guarantee measures to ensure that the work could go forward, the main models for reconstruction, and the results of reconstruction. The fourth chapter describes the experiences and primary problems of the recovery and reconstruction process. The last chapter offers policy recommendations to address the problems that arose during reconstruction.

# 1

# Industrial Development in Quake-Stricken Areas before and after the Earthquake

## Industrial Development in Quake-Stricken Areas before the Earthquake

Located in the transition zone between the Qinghai-Tibet Plateau and the Sichuan Basin, the area affected by the Wenchuan Earthquake had a firm industrial foundation. The area was rich in biological and mineral resources valuable for the development of tourism. Before the earthquake, 39 affected counties, cities, and districts in Sichuan Province made a significant contribution to the province's economic and social development.

The gross domestic product (GDP) of the earthquake-stricken area in 2007 was Y 216.61 billion, or 20.6 percent of provincial GDP. The general budget revenue of the earthquake-stricken area was 10 percent of provincial revenue as a whole, with primary industry making up 20.9 percent, secondary industry 46.9 percent, and tertiary industry 32.2 percent of the industrial economy. With abundant minerals, forests, meadowlands, wetlands, and cultural tourism resources, the area produced a significant share of the province's grain (23 percent), oil (32 percent), pork (23 percent), commercial crops (32 percent), and aquatic products (25 percent). The area also enjoyed a good foundation for industry, a well-developed tourist trade, and abundant tourist attractions. Nevertheless, except for the cities of Chengdu, Deyang, and Mianyang, the area had been relatively slow in economic development and had been relatively little urbanized, due in part to the tremendous variations in the area's resources, environmental carrying capacity, economic foundation, and geographic conditions.

Before the earthquake, 12 counties and districts in Gansu Province and Shaanxi Province had an undeveloped industrial economy; they were mainly agricultural and contributed little to the aggregate economy of the provinces. Eight seriously stricken counties in Gansu are the province's major producers of Chinese herbal medicine, potatoes, out-of-season vegetables, tea, and sericulture. Four seriously stricken counties in Shaanxi Province are also major producers of agricultural products. Small and medium-size enterprises make up most of the economy, and tertiary industry is not well developed. The economy in earthquake-stricken areas did not make up much of the economic volume of these two provinces as a whole. The GDP of the eight seriously stricken Gansu counties made up only 3.74 percent of the GDP of the province, while the four seriously stricken Shaanxi counties made up only 2.75 percent of total GDP in Shaanxi.

## Losses in Industrial Economy in Quake-Stricken Areas

All types of industry in the quake-stricken areas experienced losses.

Agricultural production was severely damaged in 38 counties, cities, and districts in Sichuan and in 12 counties and districts in Gansu and Shaanxi.

Manufacturing was also severely affected, with 12, 490 enterprises damaged in the 51 worst-hit counties, cities, and districts of Sichuan, Gansu, and Shaanxi, and with so-called pillar industries and important enterprises ruined.

The tourism industry suffered severe damage to scenic locations, hospitality enterprises, and other tourist facilities. Business fell off steeply because of the resultant sharp decline in demand. Damage in Gansu and Shaanxi dealt a blow to development of tourism in those provinces.

The cultural industry in the 39 worst-hit counties, cities, and districts in Sichuan was damaged seriously, and some key cultural enterprises and projects, infrastructure, and service facilities were ruined. The damage had a negative impact on cultural investment, production, services, and consumption.

Trade and business service networks (including grain circulation) were badly damaged in the earthquake. There were varying degrees of damage to 145, 445 networks, or 50. 77 percent of networks existing before the earthquake. Network buildings suffered substantial damage; 15. 256 million m2 of network buildings, or 60. 7 percent of the total building area, were affected.

Financial services also suffered severe damage. There were 3, 410 networks damaged to different degrees, including 2, 105 banking networks, 33 security networks, and 1, 272 insurance networks. In addition, 46 institutions working under the People’s Bank of China, Banking Regulatory Commission, Security Regulatory Commission, and Insurance Regulatory Commission were destroyed.

In sum, the Wenchuan Earthquake greatly harmed agricultural industry, manufacturing industry, tourism, cultural industry, and the market services system. It also seriously harmed the normal development of the industrial economy in the 51 worst-hit counties, cities, and districts of Sichuan, Gansu, and Shaanxi. Because the ecological environment of the quake-stricken areas was deteriorated by the earthquake, there was a decline in resource and environmental carrying capacity in the worst-hit areas, increasing the hidden dangers of secondary disasters as well as the difficulties in disaster prevention and mitigation, ecosystem restoration, and environmental conservation.

# 2

# Plan for Recovery and Reconstruction of Industrial Economy in Quake-Stricken Areas

## Guiding Ideology

To support all-round, sustainable, and coordinated development of the economy and society in the quake-stricken areas, postearthquake planning dictated that a science-based and people-oriented concept of development be implemented comprehensively, accompanied with an emphasis on respect for nature, consideration of environmental carrying capacity, and scientific reconstruction. The requirements of modern industrialization, the development of main-function zones (determined by the industrial functions and products that predominate in a given area), and increasing employment needs made it vital to rationally arrange the progress of off-site and on-site reconstruction, to optimize the distribution of productive forces, and to promote adjustment of the industrial structure. These goals were to be met by adapting plans to local conditions and giving priority to the major tasks.

**Combination of scientific planning and industrial coordination**

Scientific planning was to be combined with industrial coordination. The program for recovery and reconstruction of industrial systems in the affected areas was to be put into effect scientifically and steadily, with full consideration given to geological conditions and environmental carrying capacity. The plan emphasized the importance of coordinating the relationship between agriculture, manufacture, tourism, and cultural industry, as well as the relationship between industrial development and environmental conservation. It also emphasized respect for the traditional cultures of ethnic minorities and for harmony between man and nature.

**Adapting major tasks to local conditions**

The major industrial reconstruction tasks were to be adapted to local conditions. According to the requirements of the program for state main-function zones, the environmental carrying capacity, industrial policies, degree of reconstruction, and direction of industrial development in different areas were to be determined rationally, and comparative advantages brought into full play. The plan also indicated the importance of understanding the basic role of agriculture, the leading role of tourism, and the supporting role of manufacture in developing the characteristic priority industries.

**Optimization and reconstruction**

The plan called for industrial optimization to be combined with recovery and reconstruction, in order to improve both the distribution of productive forces and industrial development. Under the concept of a circular economy, it sought to promote the construction of a resource-friendly and environment-friendly society, to transform the development pattern, to update and renovate traditional industries, to strengthen dominant industries, and to lessen advanced technologies' energy consumption and pollution.

**Industrial development and increased employment**

Industrial development was to be combined with addressing the need to increase employment. In order to solve the most urgent problems of living and working, the industries most likely to promote the recovery of employment and social stability were to be given priority.

**Combining government direction of markets and free expansion**

Under the plan, markets were to be both directed by the government and allowed to expand freely, with the roles of government and market properly and clearly distinguished. With enterprise as the main focus, and with a reconstruction system attuned to market operation, government guidance, and social participation, the plan called for internal and external openings to be expanded, industrial transfer to be accepted positively, and the role of large domestic and foreign enterprises to be valued during the process of recovery and reconstruction.

## Reconstruction Goals

Under the plan, the production of agriculture, manufacture, tourism, and cultural industry were to be effectively reconstructed over the course of three years, with the distribution of productive forces and industrial structure simultaneously optimized. The three industrial sectors were to interact positively and develop in coordination with one another. With the goal of laying a solid foundation for the 12th five-year-plan for national economic and social development, the level of industrial development in quake-stricken areas was to equal or exceed that before the earthquake.

**Goals of agricultural reconstruction**

With the overall recovery of productivity effected by the three-year recovery and reconstruction process, the structure of agricultural productivity with distinctive characteristics was to be optimized. The coordinated development of agriculture, animal husbandry, and fishery was to be realized gradually by establishing leading enterprises with significant benefits, which would in turn drive the development of productivity and increase the income of farmers.

**Goals of manufacturing reconstruction**

The structure of manufacturing productivity was to be optimized under the three-year recovery and reconstruction process. The position of the dominant industries in major equipment, digital audiovisual equipment, and further processing of agriculture products was to be consolidated in order to expand dominant industry clusters. This plan was intended to make the distribution of productive forces more rational, to promote formation of industrial parks (centers) and distribution centers for industry within the circular economy, and to facilitate close relationships among and rational distribution of industries along with intensive land use, resource integration, and concentrated waste disposal. The total number of staff of industry and enterprises was meant to reach or surpass that before the earthquake. Energy-saving and emissions-reducing industries were to make significant developments, with a decrease of 12 percent in consumption per unit of industrial added value and of 6 percent in total pollutant discharge compared to pre-earthquake levels. Emissions for "three waste" products (industrial wastewater, waste gases, and solid waste) were to be within the standards set by government, and the treatment of industrial, agricultural, and other solid waste was to be in accordance with state regulations.

### Goals of tourism reconstruction

Through the three-year recovery and reconstruction process, the important scenic locations in the quake-stricken areas were to be generally rehabilitated, with tourist resources integrated and optimized, tourism involving earthquake relics established, and the level of tourist facilities and services improved. The confidence of tourists and investors alike, as well as the positive image of the three provinces within the domestic and foreign tourist market, was to be built up. The economic indexes for tourism were to reach 90 percent of levels specified in the 11th five-year-plan for national economic and social development; this goal demonstrates the important function of tourism in enriching and stabilizing the society.

### Goals of cultural industry reconstruction

Through the three-year recovery and reconstruction process, the infrastructure and productivity of the cultural industry, as well as the service networks of the cultural market, were to be generally rehabilitated. The structure and distribution of cultural production service networks were to be rationalized. The plan sought to satisfy people's basic cultural needs and to enhance the dominant industries associated with local culture. In addition, the structure of cultural industry was to be adapted to local economic development and to seek expansion of cultural consumption and increase in cultural employment.

## Distribution of Productive Forces

Under the Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction, quake-stricken areas were to be divided into suitable reconstruction areas, moderate reconstruction areas, and ecological reconstruction areas. Along with the environmental carrying capacity, the requirements of the state main-function zones, and the development foundation before the earthquake, the specific conditions and characteristics of the different areas were to be considered. The distribution of productive forces was to be arranged scientifically and rationally, in accordance with the local conditions and the major tasks so that the various resources of the different areas could be used most efficiently and productively.

### Suitable reconstruction areas

The plan called for the dominant industrial belts and bases to come into being with the development of relevant industries, expansion of industrial chains, and enhancement of matching capacity based on relevant conditions. Agricultural development was to stress "green" and high-efficiency agriculture, including grain and oil crop planting and processing, vegetable and silk production and processing, raising and processing of livestock, fish farming, and growing of high-value fruit, bamboo, and flowers, to contribute to a modernized tourist agriculture. Resource-friendly, land-intensive, and environment-friendly industrial parks were to be constructed in order to develop industries involved in production of major equipment, technological products, electronic information, environment-friendly materials, healthy foods, medicines, and chemicals. In order to create a Longmen Mountain cultural tourism "brand" and support the development of various styles of rural tourism such as "Joyous Farmer's Houses," the developmental emphasis of tourism and the cultural industry was to be on sightseeing and leisure activities as well as the cartoon and performance industry.

### Moderate reconstruction areas

Priority was to be given to the development of the characteristic industries of tourism and ecoagriculture and to include construction of tourist locations and moderate exploitation of the dominant mineral resources. The scale of industrial parks was to be strictly controlled by merging or transplanting existing industrial parks deemed unsuitable for recovery and reconstruction. The southeastern part of the Longmen alpine and gorge region was considered a priority area for green and high-efficiency agriculture, involving grain and oil crop planting and processing, production and processing of high-value fruits and vegetables, raising and processing of livestock such as pigs, tea and sericulture processing, growing of high-quality, high-yield bamboo, and production and processing of characteristic forest industry products.

In the northeastern part of the Longmen alpine and gorge region, priority was to be given to development of characteristic agriculture, including the further processing of beef and sheep and cultivation or production of high-quality tea, potatoes, bamboo, Chinese crude drugs, edible fungi, local nuts and fruit, silkworm, walnuts, and other products. In the Qinling Mountains, the development of green industries such as high-quality tea, Chinese crude drugs, and edible fungi was to be emphasized. The unique advantages of abundant tourist resources (some of them world-famous) and excellent conditions for combining these resources were to be brought into full play. The system of diversified tourism and cultural industry would rest on relics conservation, ecological recovery, sightseeing, and mountain leisure activities and vacations. The ethnic traditions and local cultures were to be protected by a scientific approach to developing tourism in the Tibetan-Qiang cultures and in earthquake relics.

**Ecological reconstruction areas**

Tourism, agriculture, forestry, and animal husbandry were to be developed moderately, as described above. The development of other industries was to be restricted, and the reconstruction of manufacturing enterprises in the ecological reconstruction areas was forbidden. The development of characteristic and effective agriculture and ruminant husbandry – including raising of yaks, cultivation and processing of Chinese crude drugs, and growing of out-of-season vegetables, tea, and fruit in the low-mountain, alpine, and valley zones – was to be strengthened. Ecological, cultural, and rural tours were to compose the main part of the tourism activities.

**Industrial cluster district**

The plan dictated that the layout adjustment of industrial parks should be designed to promote the appropriate development of industrial agglomeration, based on environmental carrying capacity and the categorization of areas as suitable, moderate, or ecological reconstruction areas. The recovery and reconstruction of partly damaged industrial parks was to be concentrated in suitable and moderate reconstruction areas, by means of guiding and encouraging the development of small and medium-size enterprises.

## Main Content of Industrial Reconstruction Planning

**Content of agricultural reconstruction planning**

Guided by the market and taking account of regional comparative advantages, with wheat planting declining appropriately and the multiple cropping index rising, the plan called for vigorous and steady production of high-quality grain, spinach, pork, characteristic commercial plants, and forest-based raw materials, as well as aquaculture and raising of silkworms, rabbits, and ruminants. The appropriate management of agricultural scales was to be promoted, and the structure and quality of breeds was to be improved. The professional, standard, and large-scale priority industrial bases and zones for high-quality agricultural products, characteristic forest products, livestock, and aquatic products were to be recovered and reconstructed. The high-tech and other products of modern biological agriculture were to be developed and produced, hatching and demonstration parks of biological agricultural technology were to be built, and the leading enterprises of characteristic agricultural products were to be supported and extensively reconstructed to ensure higher competitiveness and benefits, as well as the effective development of agriculture in quake-stricken areas.

**Content of manufacturing reconstruction planning**

With national industrial policy being implemented comprehensively, the projects beneficial to reconstruction and employment in quake-stricken areas were to be given priority. The recovery and reconstruction of characteristic and advantageous industries (raw materials, machines, consumer goods, electronic information) were to be speeded up by promoting high-tech industry, eliminating backward productivity, guiding industrial clusters and the circular economy, and improving regional industrial competitiveness.

**Content of tourism reconstruction planning**

Environmental, cultural, and earthquake-related tourism, along with rural tourism characterized by "Joyous Farmer's Houses," were to be intensively developed. To bolster the area's tourism "brand," the recovery and reconstruction of the tourism industry was to be accelerated, the spatial distribution and structure optimized, the facilities for and quality of tourist services improved, and the image of tourism rebuilt and upgraded.

**Content of cultural industry reconstruction planning**

The infrastructure of the local cultural industry, with its distinctive local characteristics, was to be rebuilt. Moreover, the urban and rural cultural industry were to be restored (the latter in particular to satisfy the needs of rural residents), and the cultural market and supply of cultural products stimulated. The rebuilding of cultural industry bases and clusters of regional characteristic cultural industry was to be accelerated; in order to promote the structural adjustment and to optimize the spatial distribution of the cultural industry, backbone enterprises were to be cultivated and characteristic cultural industry belts constructed.

**Content of planning for market service system reconstruction**

The market service systems that were to be reconstructed included networks of retail products and services as well as systems for logistics, slaughter processes, grain circulation, financial services, and market supervision.

## Main Tasks of Industrial Reconstruction

**Tasks of agricultural reconstruction**

The first task was to be the strengthening of organization and leadership to create a good environment for agricultural reconstruction. Governments at all levels and all concerned departments were expected to give priority to this goal and to take powerful measures to promptly solve existing problem and difficulties. In order to promote the sustainable and healthy development of agricultural production, the agricultural recovery was to be energetically supported by relevant aspects of other projects and by capital, technology, and management, in accordance with the functions of departments of development and reform, finance, water conservancy, poverty alleviation, supply and marketing, technology, business, and quality inspection.

The second task was to be support for agricultural recovery and development by means of a multichannel investment mechanism. Recovery funds were to be raised through multiple channels, including government investment, charitable contributions, the "twin assistance" mechanism, and market operations, all of which were mean to stimulate farmers' productivity as well as agricultural restoration and development. The relevant provincial fiscal departments were to provide strong and stable policy support in order to augment the funds annually with new financial resources, integrate the special funds for comprehensive development of agriculture and poverty alleviation, and expand the development of agricultural key projects and leading industries.

The third task specified that the recovery of facilities be accelerated and the foundation of agricultural development consolidated. It was considered especially important to restore the farmland and agricultural facilities damaged by the earthquake and subsequent disasters; guided by a comprehensive plan and a spirit of collaboration, the restoration was to make use of machinery on loan from other parts of the country. According to the requirement of standardized production, the impaired livestock and poultry facilities, plastic tents, household hydraulic biogas digesters, and rearing houses were to be restored quickly.

The fourth task called for the structure of agricultural industry to be adjusted and optimized. Agricultural industrialization was to proceed according to the following development process: core technologies → major products → dominant characteristic new industries → agricultural recovery and reconstruction after earthquake → regional agriculture → modern agriculture.

The fifth task was improvement of agricultural industrialization management, specifically the cultivation and development of leading enterprises and farmer specialty cooperative organizations.

**Tasks of manufacturing reconstruction**

The first task of manufacturing reconstruction was to be development of the manufacturing economy in quake-stricken areas in coordination with the layout of the main-function zones; this work was to proceed under classified guidance, with scientific distribution and priority The already-developed areas were expected to possess a good environmental carrying capacity and conditions for further development, such as plentiful land and resources, the potential of attracting investment, capacity for gathering relevant industries, multiple cultural facilities, and a hospitable environment.

The second task was to be increase of old industrial bases' functionality in order to drive industrial development in Chengdu, Deyang, and Mianyang. The process of urban integration in Chengdu and Deyang was to be fostered in order to encourage the distribution of heavy equipment industry in Deyang in the manner of the plains areas and Chengdu. Specifically, the automobile industry, construction equipment industry, and building material industry in Chengdu were to be modeled on those of Deyang to create similar dominance among those industries.

The third task was to be energetic promotion of industrialization and economic development to support the industrial economy in quake-stricken areas. The best environment and conditions were to be created for entrepreneurship and employment, for a higher standard of living, and for overall social stability. The development of central cities was understood to depend on the economy of county areas, that is to say, the development of Chengdu, Deyang, and Mianyang was seen as determined by the progress of recovery and reconstruction in the nearby areas.

The fourth task was to be addressing

ecological conditions in quake-stricken areas through environmental conservation and construction. Industrial reconstruction in headwaters, in riverside areas, and in geological fault zones was to be combined with ecological barrier construction in the upper reaches of the Yangtze and with exploitation and harnessing of the Min River in order to develop an ecological economy and guarantee water resources in Chengdu, Deyang, and Mianyang.

The fifth task was to be construction of high-tech industrial zones boosted strategically through industrial centralization. The industrial revival was understood to depend on the Chengdu high-tech development zones, the Chengdu economic technology development zones, the Chengdu export processing zones, the high-tech zones in Deyang and Mianyang, and the industrial zones generally.

The sixth task was to be development of high-tech industries and subsequent strengthening of the industrial economy in quake-stricken areas. Having the advantages of low energy consumption and high added value, the high-tech and modern service industries were considered the proper direction of economic development in the future.

**Tasks of tourism reconstruction**

The first task of tourism reconstruction was to be consideration of tourism economic zones. The industry's comparative advantages were to be encouraged as tourism underwent a comprehensive reform. The distribution and the structure of tourism sites and products were to be upgraded rationally, and wellness tourism and rural tourism developed energetically. Innovations in travel agency management were to be promoted and markets expanded, in part by creating a tourism public-information service under the developing public service system.

The second task was to be construction of major tourism information projects, such as a platform for western highlands tourist information, a comprehensive database of tourism, and government website dealing with tourism. These projects were to be promoted in order to raise the level of tourist information in the quake-stricken areas.

The third task was to be rescue and conservation of cultural and natural relics and ethnic traditions in affected areas. Famous scenic spots, tourist facilities, and cultural relics were to be rehabilitated and reconstructed rapidly. In conjunction with restoration of transportation infrastructure after the earthquake, priority was to go to restoration of roadways used by tourists and tourist service facilities.

The fourth task was to be restoration of confidence, both at home and abroad, in tourist security and site accessibility in the quake-stricken areas.

**Tasks of cultural industry reconstruction**

The first task of cultural industry reconstruction was to be ensuring the quality of recovering historical and cultural heritages, such as historical cities, counties, and villages, as well as of natural relics.

The second task was to be promoting the construction of regional characteristic industry bases and the centralization of cultural industry, projects, and capital.

The third task was to be facilitating the strategic transformation of cultural industry development in quake-stricken areas as part of the overall transformation of development modes and the cultivation of new economic growth points.

The fourth task was to be prompt rescue, restoration, and conservation of key historical relics.

## Process of Industrial Projects Following Mid-Term Adjustments

During the postdisaster recovery and

reconstruction, the Chinese government and relevant provincial departments adjusted the content of the recovery and reconstruction program in the quake-stricken areas as the need for change arose.

**Progress in production structure and industrial projects**

By the end of September 2011, 4, 989 projects had been begun in the fields of manufacture, tourism, cultural industry, and financial service, or 100 percent of the reconstruction tasks planned. Among these were 3, 130 projects of manufacture, 186 of tourism, 1, 634 of culture, and 39 of financial service. There were 4, 957 projects completed, representing 99. 3 percent of the planned projects; the cumulative investment was Y 13. 5996 billion, or 99. 35 percent of the planned investment volume.

**Progress in market service system projects**

By the end of September 2011, 6, 239 projects for trade, business, and grain circulation facilities had been begun, or 100 percent of the reconstruction tasks planned. Of these, 6, 218 projects were completed, representing 99. 66 percent of the planned projects; the cumulative investment was Y 23. 139 billion, or 99. 13 percent of the investment planned.

# 3

# Recovery and Reconstruction of the Industrial Economy in Quake-Stricken Areas

## Security Measures for Recovery and Reconstruction of the Industrial Economy

A range of policies – involving finance, tax collection, industry, land, and employment – was used to coordinate the central and local funds, as well as funds from the twin assistance program and bank loans, that financed recovery and reconstruction.

**Preferential policy guarantee**

The central government publicized supportive policies for taxation, finance, investment, industry, land, social insurance, and employment. Related policies and measures were also put into effect to create a recovery and reconstruction policy guarantee system with distinctively Chinese characteristics and characteristics of local affected areas.

**Capital and technology guarantee**

Capital for use in reconstruction of agriculture, manufacture, tourism, and cultural industry was guaranteed. The reconstruction funds were allocated and used by adhering to the following guidelines: an overall arrangement was made, the key points were stressed, control of funds was based on project classification, and special funds were available through the project's completion. The overall arrangement of reconstruction funds was in the following order: donation funds, assistance from counterpart provinces (under twin assistance), reconstruction funds of the central government, reconstruction funds of the provincial government, and credit funds. This arrangement provided a solid financial foundation for postearthquake reconstruction.

With reconstruction funds coming from the central government, none of the projects was impeded by an ineffective allocation of funds. Through the end of June 2010, the total volume of central finance funds for reconstruction in Sichuan Province was Y 215.624 billion, representing 97.9 percent of the total funds available until projects were completed. Of the Y 215.624 billion, Y 202.39 billion, or 93.9 percent, came from the provincial financial budget.

**System guarantee**

The system established for postdisaster industrial reconstruction integrated national assistance, twin assistance from donor provinces, and assistance from the society and individuals affected by the earthquake. Self-reliance was an important principle for reconstruction, but an event as catastrophic as the Wenchuan Earthquake required that the central government be involved in reconstruction. Both the central and provincial governments determined appropriations for postearthquake reconstruction; this arrangement played a crucial role in reconstruction implementation. The distinctively Chinese reconstruction system – which relied on twin assistance from donor provinces, combined "blood transfusion" (outside support) and "blood creation" (self-development), and integrated material support with psychological and emotional support – brought about the reconstruction of 18 seriously stricken counties in Sichuan Province.

## Main Models of Recovery and Reconstruction of the Industrial Economy

Depending on local conditions, postdisaster industrial reconstruction was carried out following one of four major reconstruction models. The first was the enclave industrial park model. This model took account of the quake-stricken area's resources and those of the site where industry was to be relocated and sought to promote the mutual development of both areas through complementary advantages and sharing of benefits.

The second model was joint industrial park construction, under which the quake-stricken areas and donor provinces and cities jointly built the industrial park on site; under this model, the industrial distribution in the quake-stricken area was adjusted, and efforts made to attract enterprises into the parks, develop the characteristic dominant industries, and effect industrial transfer from the areas providing aid, again to realize the complementary advantages of benefits sharing.

The third model was that of the circular economy industrial park. Under pilot projects to promote circular industrial development in major enterprises, parks, businesses, fields, counties, and cities, a variety of methods and channels have been used to show typical leading and demonstrating functions and to realize the positive interaction between the micro-level, medium-level, and macro-level circles. The last is the model relevant to earthquake relic conservation. In order to conserve relics of and construct memorials to the devastating earthquake, it was necessary to fully exploit the relics' ability to commemorate the earthquake and educate people about it. The Sichuan provincial government and party committee are engaged in the program for reconstructing the relics and remains of the earthquake along with earthquake memorials.

## Results of Recovery and Reconstruction of the Industrial Economy

This section describes and analyzes the results of postearthquake industrial reconstruction.

### Agricultural reconstruction

Sichuan Province promoted the recovery and reconstruction of damaged farming facilities and the development of agriculture at the same time. As a result, agricultural reconstruction in the province progressed very well; there have been continuous increases in grain yield and fast growth in animal husbandry and in agricultural product processing. The rural economy overall has been developing quickly and the income of farmers has risen. Specifically, in 2010, total output value in Sichuan reached Y 1.68986 trillion, an increase of 15.1 percent over the previous year, with a Y 248.3 billion contribution by primary industry, representing an increase of 4.4 percent over the previous year.

### Industrial reconstruction

Based on the idea of combining restoration of function with development in the quake-stricken areas, a sustainable industrial development plan was made according to the condition of local industrial development. The goal was to promote further innovation in the industrial development model, to optimize industrial structure, and to improve development quality. Ideally, corporate productivity will also be directly promoted, technology transformation accelerated, industrial structure prioritized, and corporate competitiveness enhanced through the recovery and reconstruction of industry.

As a result of industrial reconstruction, the adjustment of industrial structure in affected areas of Sichuan has made great progress, and industrial layout has improved. The effects of industrial reconstruction can be seen in the fact that industrial value added for six of the worst-hit cities exceeded the average level of the province.

**Tourism reconstruction**

Because tourism has had a positive impact on employment and hence on social stability, governments in the quake-stricken areas made tourism the leading industry in the reconstruction project. They considered restoration of key scenic spots and tourist service facilities especially important.

As a result of reconstruction, tourism in Sichuan Province recovered very quickly from the disaster; it has been above pre-earthquake levels since 2009. In 2009, income from tourism exceeded Y 100 billion, a level previously reached in 2007. The exact amount of income, Y 147. 2 billion, was an increase of 21 percent over 2007. Total income from tourism in Sichuan Province in 2010 came to Y 188. 609 billion, an increase of 28. 1 percent over the previous year.

**Cultural industry reconstruction**

After the earthquake, the Culture Department of Sichuan Province reacted quickly. It issued the Overall Plan for Cultural Reconstruction of Sichuan Province and started key cultural reconstruction projects, including rescue and protection of antique buildings in Dujiangyan.

As a result of cultural reconstruction, at the end of 2009 the value of cultural assets in Sichuan Province had reached Y 39. 943 billion, and the number of people employed by the industry had reached 333, 800. Both these figures represent an increase of more than 50 percent over pre-earthquake levels. By the end of 2009, the cultural industry operating revenue for Sichuan Province had reached Y 38. 082 billion, an increase of Y 10. 263 billion over pre-earthquake levels; the cultural industry's contribution to the province's GDP had risen to 0. 82 percent. Over 25, 000 companies were engaged in the cultural market, earning about Y 17. 2 billion; both these figures surpass those before the earthquake.

# 4

# Recovery and Reconstruction of the Industrial Economy: Experiences and Problems

## Experiences of the Recovery and Reconstruction Process

### The advantages of the Chinese political and economic system

Confident in the capacity of socialist principles to guide substantial undertakings, the Communist Party Central Committee and the State Council quickly began postearthquake industrial reconstruction. In addition to financial support for reconstruction from the central government, assistance came from donor provinces, either through joint construction or another industrial reconstruction model.

Experience suggests first that reconstruction on this scale required good leadership and clearly assigned responsibilities. The State Council made clear that the major responsibilities and obligations of reconstruction belonged to local governments in the quake-stricken areas. The provincial governments, which were in charge of the reconstruction work in their own cities and counties, took charge of, coordinated, and supervised the execution of reconstruction projects and made annual reconstruction plans. The municipal governments and the county governments were responsible for the construction and development of urban and rural housing, of agricultural infrastructure, and of public and social services; they were also responsible for disaster prevention and reduction, restoration of the ecosystem, environmental protection and management, and land improvement and reclamation. Tasks involving transportation, communication, resources, water supply, and some other cross-administrative projects were handled by the municipal governments and the State Council. Good leadership and clear divisions of responsibility made it possible to determine the exact number and true condition of disaster-hit areas so that a proper and immediate response could be planned and a fact-based, scientific reconstruction could go forward. The system for assessing reconstruction work also helped to ensure that all parties fulfilled their responsibilities and produced work of good quality within the time limit.

Second, the experience of industrial reconstruction confirms the importance of self-reliance and hard work – each a tradition of the party and an inheritance of the Chinese people. The country as a whole and the provinces both supported reconstruction; citizens and officials in quake-stricken areas worked industriously to reconstruct their new homes and sought to ensure that funds were used where they were most needed, that projects satisfied people's needs, and that the reconstruction offered the greatest possible economic, social, and environmental yield. A comprehensive and balanced plan, precisely calculated and made in accordance with different actors' abilities, was generally successful. Communication between the donor provinces and the affected provinces – about reconstruction tasks, methods, and standards – made it possible to devise feasible reconstruction plans that took the actual conditions of affected provinces into account; communication also prevented misunderstandings that might have arisen either because of regional differences between donor and recipient provinces, or because of differences across the affected areas. Officials at all levels worked on the front lines to solve the problems that occurred during reconstruction. Corporations based in other provinces and foreign countries were encouraged to open markets in the quake-stricken areas with available resources as well as to support industrial development, technology, talent, and investment acquisition, all of which strengthened the self-developing ability of industries in quake-stricken areas.

Third, effective guidance and ongoing support were instrumental in carrying out the work of reconstruction. Departments under the State Council were assigned different jobs according to their duties; they organized the execution of ad hoc projects and helped guide and coordinate reconstruction work. Once approved by the National People's Congress, appropriated funds arrived on time, to be used for their specified purpose only. Urgently needed reconstruction projects were prioritized. Moreover, all involved parties gave their full support and cooperation in assembling and transporting needed materials. Policies related to finance, taxation, land, and industry were issued, and concrete measures addressing urban and rural off-site reconstruction, citizen settlement, regional balance, and raising of capital were implemented. Relevant laws, jurisdictional interpretations, and supporting regulations – for example, about the right to dispose of land after destruction of buildings on it, the operational right of contractors after rural land was destroyed, and the obligations incurred after buildings were damaged – were amended. The State Council and functional departments of provincial governments in the quake-stricken areas conducted research to better understand the process of reconstruction, and they implemented relevant policies to help solve practical problems encountered during reconstruction.

**Reconstruction in accord with national characteristics and situation of quake-stricken areas**

Under the guidance of the Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction and related ad hoc plans, all participants in the reconstruction sought to use reconstruction modes suited to the characteristics of the quake-stricken areas and possessing distinct Chinese features. A series of industrial and economic reconstruction modes was created after the Wenchuan Earthquake; each mode shared five distinctive features.

First, reconstruction modes assumed self-reliance and independence among quake-stricken areas, as well as assistance from the outside. Financial support for industrial and economic recovery in the affected areas came from the central fiscal system and from donor provinces; primary-level governments and citizens of quake-stricken areas were also expected to take initiative and use creativity in implementing industrial reconstruction. This approach of internal and external support was intended to improve the efficiency and quality of industrial reconstruction.

Second, reconstruction modes involved horizontal and vertical cooperation among governments at all levels. During the industrial reconstruction, wide, deep, and efficient coordination and interaction took place between functional departments of central government, between the central government and provincial governments in affected areas, among functional departments of provincial governments in affected areas, and between donor provinces and affected provinces. Furthermore, relevant policies were modified to solve problems and conflicts and ensure that the reconstruction work was organized and efficient.

Third, the reconstruction modes were based on law and science. Industrial reconstruction followed relevant national laws, regulations, policies, and programs, which were revised and improved as necessary to bring reconstruction work in line with objective conditions. The organic combination of law-based and science-based management was a key factor in efficient industrial reconstruction.

Fourth, the reconstruction modes effectively integrated central reconstruction and democratic reconstruction. China is a socialist country that believes in concentration of resources to accomplish large aims and that sees this concentration as the political foundation for stability and prosperity and as the means of rejuvenating the country. With its National People's Congress, China is also a democratic state, which respects peoples' right to be informed, to participate, and to make suggestions, as well as some other rights. During the industrial reconstruction, China effectively integrated central reconstruction with democratic reconstruction so that the reconstruction work proceeded efficiently and kept abreast of actual conditions and the real needs of citizens.

Fifth, the reconstruction modes incorporated systematic innovation. Attention was given not only to the recovery and reconstruction of industrial infrastructure and industrial zones, but also to exploration of feasible industrial reconstruction systems. As a result, enclave industrial zones, joint-construction industrial parks, and some other industrial reconstruction modes were created. The problem of prioritizing infrastructure reconstruction while ignoring systematic innovation was overcome in this way, offering valuable experiences for reconstruction work in the future.

**Promotion of the industrial economy's self-development**

One highlight of the reconstruction work was the value placed on promoting the industrial economy's self-development. The quake-stricken area's long-standing problem of relying on external help while overlooking development of its own abilities and independence was well handled during the reconstruction. The central government and provincial governments of affected areas increased funds for industrial reconstruction and emphasized formation of a mutually beneficial development pattern with respect to construction of industrial infrastructure such as industrial parks. Corporations based in donor provinces invested in affected provinces' unique and distinctive resources, creating a win-win situation. This approach not only inspired the donor provinces to transfer their industries, but also enhanced the economic power and self-development ability of the recipient provinces. Moreover, recovery of productivity was combined with adjustment of structure and transformation of development mode, so that industrial transfer was united with structural optimization, and the promotion of advantageous industries went along with acquisition of capital and advanced corporations.

**Active adjustment and optimization of economic development structure in quake-stricken areas**

The environmental bearing capacity of quake-stricken areas and the original layout of industrial zones were taken into account when distributing productive forces in suitable reconstruction areas, moderate reconstruction areas, and ecological reconstruction areas. On-site reconstruction of damaged industrial zones in suitable and moderate reconstruction areas was speeded up to encourage and guide creation and development of small and medium-size companies, to guide clustering development of corporations, and to achieve positive results from structural optimization.

Specific measures were as follows: First, industrial layout was adjusted and optimized, existing national and provincial development zones were put into full play, central layout of enterprises was encouraged, and distinctive and advantageous industrial clusters were cultivated. Second, given that some of the industrial zones in quake-stricken areas had been reconstructed off-site, dismantled, or merged, parts of existing national and provincial development zones were extended. Third, circular economic industrial clusters were newly established, an enclave economy was promoted, and off-site reconstruction in moderate and ecological reconstruction areas was undertaken to attract other enterprises to concentrate in the industrial zones. Fourth, joint construction of industrial zones by donor and recipient areas was supported if distribution was reasonable; the intention was to attract and promote industrial transfer in the eastern and central regions.

**Innovative financial support system for industrial development**

During the industrial economic reconstruction after the Wenchuan Earthquake, fiscal departments at all levels created a financial support system that differed from the previous approach by offering both financial relief and reconstruction capital, and that thus encouraged active participation of credit funds and social funds in industrial reconstruction and development. Efficiency in use of financial relief and reconstruction funds improved to varying degrees, as follows:

First, central and provincial capital was used to fund infrastructure reconstruction. Reconstruction of infrastructure, especially of industrial zones, was prioritized and hence provided essential prerequisites for attracting further investment and credit loans. Second, fiscal departments at all levels used capital injection to establish investment companies in the quake-hit areas, which later became leaders in exploiting resources and great promoters of the local industrial economy. Third, fiscal departments usually set up credit guarantee companies through interest discount, compensation, reward, and fund infusion; set up development funds for small and medium-size enterprises; and made favorable policies (such as compensation for the property insurance premiums of corporations and institutions and compensation for farmers and herders) in order to encourage banks and financial systems to expand credit availability for enterprises in the quake-stricken areas. Fourth, fiscal departments carried out preferential policies to abate taxation, which also served to inject capital into industrial reconstruction and in turn encouraged further development of and investment in industries in quake-hit areas. In short, fiscal departments at all levels strived to create a financial support system and mechanism for industrial development during reconstruction. The leverage effect of fiscal funds was made clear, and fiscal funds' ability to support industrial reconstruction and development was highlighted.

**Innovative financing mode for development of characteristic advantageous industries in quake-stricken areas**

Because the most prominent advantage of Wenchuan is its plentiful resources, it made sense to restore and reconstruct the area's industrial economy by way of vigorously developing characteristic advantageous industries. However, a shortage of funds made development of these industries difficult. The funding shortage can be explained as follows: The financial fund, which was the material foundation allowing fiscal departments to fulfill their financing obligations, could not be used directly and substantially for the development of these industries because it was supposed to be used to provide public goods such as education, defense, and so on. In addition, the development of characteristic advantageous industries required a relatively long cultivation period and was comparatively risky, which made it harder to get support of credit funds and social funds.

The problem of capital shortages was solved by bravely creating an effective financing mode, one not confined to a single financing pattern, that would tap the capital-supply potential of all channels and raise abundant funds for reconstruction and development of characteristic advantageous industries; this mode was based on the real conditions of resources, the environment, and the industrial foundation in quake-hit areas and on the limits imposed by laws, rules, and regulations.

The mode operated in this way: First, financial funds from fiscal departments at all levels were encouraged to invest in construction of industrial zones with the intention of building a platform and welcoming environment for clustering development of characteristic advantageous industries in quake-stricken areas. Second, favorable fiscal and taxation policies were introduced to encourage and guide investment from banks and civil investing bodies. Third, governments at all levels set up a series of new financing funds and used capital infusions, investment compensation, loan subsidies, and money reward to encourage banks and social investors to invest in the reconstruction and development of characteristic advantageous industries in quake-stricken areas. Fourth, pieces of construction land were made available through land reclamation, and the transfer payments for the reclamation were injected into construction of industrial zones. Contractors who leased land held collectively by farmers were permitted to use and profit from the land, an arrangement that attracted capital from leading industrialized agricultural corporations, raised farmers' income, increased the degree of industrial organization, improved market position, and enlarged the capital source for development of modern agriculture in quake-stricken areas.

## Problems Encountered in Restoration of the Industrial Economy

The industrial economy in the Wenchuan area suffered huge losses in the earthquake. Restoration and reconstruction of the industrial economy, carried out jointly by the central government and local governments and aided by the donor provinces and by hard-working officials and citizens in the quake-hit areas, achieved a great deal. Some nonnegligible problems and shortcomings remain, however, that should be addressed as development occurs in the future.

The first problem is that slow cultivation of characteristic advantageous industries impeded the economic self-development ability of the quake-stricken areas. Economic recovery relied on the pulling power of reconstruction investment, on the support of preferential policies, and on help from donor provinces. But the economy of some quake-stricken areas has not recovered yet owing to the areas' insufficient power of internal development, to industries' inability to withstand risks, and to their unstable development foundation.

There are various reasons why the area and its industries show these weaknesses – for instance, industries are backward in technology and management, they have heavy debts, they have great difficulties in raising funds, they are not rationally structured, the position of leading industries is insufficiently prominent, and so on. The weakness of industries' self-development ability is also partly explained by characteristic advantageous industries' lack of prominence, the low concentration of industries, the backwardness of industries, the weak constellation effect of industries, the great pressure to eliminate backward production capacity, and the difficulty of upgrading and optimizing industrial structures. However, the most direct, realistic, and controllable explanation for industries' poor self-development ability is the slow cultivation process of characteristic advantageous industries, which made it almost impossible for industries to optimize and upgrade their structures and created many barriers to their development. In order to enhance the self-development of the industrial economy, the cultivation process of typical industries should be accelerated to help the industries break through the strict constraints that currently impede self-development.

A second problem remaining following postearthquake industrial reconstruction is that the industrial structure of quake-stricken areas was not rational enough to allow full use of areas' own comparative advantages. During the industrial reconstruction, positioning for development of industries was ambiguous or incorrect, and development policies and measures of specific industries were wrong or inappropriate, leading to the a shortage of strong backup among leading industries and weak ability for self-development and sustainable development, problems that were especially manifest in hindrances to industrial structural adjustment and optimization. Not a few quake-stricken areas blindly pursued a high-level, sophisticated industrial layout, which failed to make use of the resource advantage, industrial foundation, and market condition of the disaster-hit areas, failed to satisfy the need for employment, failed to promote industrial reconstruction and development based on actual conditions, and failed to effectively use characteristic agricultural and animal husbandry resources, mineral resources, cheap labor resources, and favorable policy resources. In fact, the relationship between adjustment and optimization of industrial structure and effective use of comparative advantages should be a mutually beneficial, stimulative one. The two factors can be understood as two sides of the same coin. On the one hand, rational industrial structure facilitates effective use of comparative advantages in quake-stricken areas. On the other hand, making full use of comparative advantages is also conducive to adjusting and optimizing the industrial structure.

A third problem is that the slow pace of the industrial transfer carried out by the donor provinces harmed continuous development of the affected area's industrial economy. During the industrial reconstruction after the Wenchuan Earthquake, a group of enclave industrial zones and joint-construction industrial parks was established by the 18 donor provinces, facilitating recovery and development of the industrial economy in the quake-stricken areas. However, these expensive new industrial zones are currently unused because the relevant industrial transfer from the donor provinces has yet to be completed. They represent a waste of capital, and the slow industrial transfer is slowing down development of the industrial economy in the quake-stricken areas. The country should carry out incentive policies and measures as soon as possible to encourage donor provinces and recipient provinces to form a long-term cooperative relationship based on mutual benefits, to accelerate the pace of industrial transfer to quake-stricken areas, and to achieve the goals of boosting economic revival in quake-stricken areas, effecting industrial upgrade in advanced areas, and promoting balanced economic growth in all areas.

A fourth problem emerging after industrial reconstruction is that rigid conditions for industrial financing in the quake-stricken areas kept characteristic advantageous industries from developing as rapidly as they might have. It is true that central and provincial reconstruction funds, funds from donor provinces, social donations, and some other unconventional capital all played a vital role in economic restoration after the Wenchuan Earthquake, while the powerful credit fund failed to fulfill its supporting function, and civil investment also had a limited influence. But with industrial reconstruction almost finished, and a new phase of industrial revival underway, the unconventional funding is essentially depleted, and the result is a more severe shortage of investment capital. Clearly, whether the great problem of raising capital can be solved will largely determine prospects for industrial development in the quake-stricken areas. Governments at all levels should understand the importance of rewarding the financing market, and they should actively promote innovative financing systems and investment mechanisms that would open up diverse and marketized financing channels with Chinese characteristics and be consistent with the unique features of the quake-stricken areas. In this way they could help to ensure reliable capital reserves for future industrial development and revival.

# 5

# Policy Recommendations

With industrial reconstruction of quake-stricken areas at an end and a new stage of industrial revival underway, the problems that remain after the reconstruction process are evident. The following policy proposals aim to provide solutions to the most pressing of them.

## Develop Characteristic Advantageous Industries and Strengthen Quake-Stricken Areas' Self-Development Abilities

Because the development status of characteristic advantageous industries will primarily determine whether the goal of industrial revival can be accomplished, cultivating these industries is crucial. The provincial party committees and the provincial governments of Sichuan, Gansu, and Shaanxi understood this and were admirably thorough in researching the fundamental conditions for development of the industrial economy in these three provinces. They arranged the development sequence of industries in every quake-stricken city and county on the basis of scientific study and considered that sequence an important reference as cities and counties sought to position their industrial development and plan their industrial layout. After the industrial position and layout were settled, the cities and counties were supposed to report the plan to the government for the record.

To promote development of the characteristic advantageous industries, the quake-stricken cities and counties should select several of the industries according to their own positioning and layout plan, then choose three strategic supporting industries and one leading industry from among them. The final choice should be required for the record.

Efforts should be made to attract investment to the leading industries, which would enjoy the most favorable investment policies; to supporting industries, which would enjoy relatively favorable investment policies; and to the characteristic advantageous industries, which would enjoy less favorable investment policies.

In addition to offering preferential fiscal and taxation policies, efforts should also be made to establish supportive institutions for industrial development, such as credit guarantee companies whose power is limited within the jurisdiction region, and industrial development funds and companies that could provide an industrial financing platform. These institutions would help to speed up the cultivation of characteristic advantageous industries and to strengthen the self-development abilities of quake-stricken areas; they would also encourage channeling of capital resources into county characteristic advantageous industries, especially in the leading industries and supporting industries.

## Make Use of Quake-Stricken Areas' Comparative Advantages by Adjusting and Optimizing Industries' Economic Structure

Attention should be focused on the adjustment and optimization of industrial structure in the next phase of industrial revival so that the industrial structure of the quake-stricken areas can be rationalized and advanced and gradually become more appropriate. The affected areas' plentiful and distinctive resources should be fully used and their comparative advantages completely exploited. While the comparative advantages of the quake-stricken areas are gradually exercised, the industrial structure can be optimized; this step would reinforce the effects of industrial structure adjustment carried out at the previous stage. Then the more optimized industrial structure would in turn further promote exertion of the comparative advantages at a higher level. If the circle goes on, the adjustment and optimization of industrial structure and the exertion of comparative advantages would mutually reinforce each other, thus facilitating the development of a better, faster, and bigger industrial economy in quake-stricken areas.

Ecology and culture, which are of great value to county-level economic development, should be highlighted in affected areas in future positioning of industrial development. The usual processing projects should be strictly controlled; projects with high energy consumption, heavy pollution, or low economic returns should be banned; and the cultural industry, tourism industry, and cultural tourism industry should be promoted as part of a resource-conserving, environmentally friendly, and economically efficient way to develop characteristic advantageous industries.

Four specific steps are recommended. First, the development mode of the quake-stricken areas should be transformed from reliance on donor provinces to self-reliance, so that the industrial economy of quake-stricken areas can develop healthily. Second, attention should be paid to protection and construction of the ecological system, and the development of characteristic advantageous industries should be prioritized in order to ensure a development track in keeping with the distinctive features of the quake-stricken areas. Third, project registration and initiation should be carefully examined. Backward production capacity has to be eliminated to promote optimization of industrial structure of quake-stricken areas. Fourth, the distinctive ecology and culture of the quake-stricken areas should be taken full advantage of in order to boost development of ecology-based industry and a characteristic cultural tourism industry.

## Speed Up Relevant Industrial Transfer from Donor Provinces and Construction of Industrial Zones in Quake-Stricken Areas

As industrial recovery and reconstruction is completed, the quake-stricken areas have headed into a new phase of industrial revival. During this new phase, all quake-stricken areas should leave behind their role as aid recipients and adopt the role of collaborative partners with donor provinces; in this way they could break the long-standing reliance on external help and instead pursue a wide-ranging, deep, and mutually beneficial cooperative relationship with other investment parties, especially the donor provinces, based on market principles.

Specific measures to bring this change about include the following: First, the central government should carry out necessary preferential policies and measures to encourage relevant industrial transfer from donor provinces to industrial zones of quake-stricken areas while ensuring that donor provinces do not suffer great losses from industrial transfer and that the transferred industries are economically motivated. Second, the provincial governments of Sichuan, Gansu, and Shaanxi should carry out ad hoc favorable policies and measures for the industrial development and revival of their own provinces so as to guide industrial transfer to industrial zones from both inside and outside the province and to further motivate industrial transfer with interests and benefits. Third, municipal governments of quake-stricken areas should also carry out stimulative policies and measures on the basis of their own financial situation to positively lead parties from both inside and outside the cities to invest in the industrial zones. Fourth, county governments of quake-stricken areas should carry out preferential policies and measures in their power and make use of the regulative leverage of land policies to attract investment from all sources in order to promote county industrial development and revival.

In summary, efforts should be made by all investment parties to speed up industrial transfer to industrial zones in quake-stricken areas; this step should boost development of industrial clusters in affected areas and help improve the quality and cost efficiency of industrial development there. At the same time, service facilities in the industrial zones should be improved to promote better and faster development of the industrial economy in quake-stricken areas. Finally, it should be possible to simultaneously achieve the policy objectives of industrial development and revival in quake-stricken areas, upgrade industrial structure in advanced areas, and promote balanced development of regional economies.

## Create Financing Systems and Mechanisms to Promote Industrial Development and Revival in Quake-Stricken Areas

With industrial development and industrial revival underway, diversified and marketized financing methods have become the main approach to financing industrial projects. However, this approach has some serious defects and shortcomings. Most enterprises have great difficulty in securing financing; this is particularly true for small corporations. Industries in the quake-stricken areas, where development of the industrial economy has been relatively laggard and industries are often small, low-tech, and poorly managed, have even more trouble arranging financing. Solving or effectively mitigating these financing difficulties is therefore critical for industries' development prospects.

Specific measures to address financing problems include these:

First, it is important that fiscal policies and financing policies be appropriately integrated in extending financing channels for industries in quake-stricken areas. An effective system and mechanism should be established involving fiscal funds, credit funds, and social funds, while also adhering to the industrial financing principle that allows fiscal funds to take the lead over other funds.

Second, emphasis should be placed on development finance institutions that played an important role in promoting industrial development and revival in the quake-stricken areas. Governments at all levels in the quake-stricken areas should take the initiative to communicate and consult with the China Development Bank and enhance cooperation between government and the bank. If governments' organizational abilities and development finance institutions' financing abilities are used fully, the defects and shortcomings of the market system and mechanism can be avoided; in turn, the development and revival of the industrial economy in quake-stricken areas can be boosted.

Third, financial institutions of various sizes – medium-size, small, and very small – should be fostered in order to lay a necessary foundation for large-scale wholesale financial institutions' participation in the development and revival of the industrial economy in quake-stricken areas. The cultivation and development of all kinds of collaborative financial institutions should be especially emphasized in order to actively explore the specific methods that allow collaborative financial institutions to concurrently handle credit businesses.

Fourth, efforts should be made to encourage more – and higher-quality – investment in the quake-stricken areas and to absorb foreign funds into characteristic advantageous industries. Meanwhile, it should be recognized that relieving citizens in quake-stricken areas by giving them employment instead of outright grants works to mitigate the capital shortage.

1 The disaster areas refer to the 51 counties, cities, and districts of Sichuan, Gansu, and Shaanxi Provinces severely affected by the earthquake.

# PART SIX

## Evaluation of Wenchuan Earthquake Postdisaster Reconstruction Efforts:

## Investigative Report on Off-Site Reconstruction of Counties and Towns

# Introduction

The Wenchuan Earthquake, which took place on May 12, 2008, caused tremendous damage over a very wide area and involved extremely difficult rescue work. In Sichuan Province, which suffered the greatest damage, there were 10 extremely hard-hit districts and counties. The combination of severe damage to infrastructure with disadvantageous geographical location meant that reconstruction of some towns had to take place in a new location – that is, off site. [1]

The research group producing this report used three criteria – severe disaster damage, careful reconstruction site selection, and difficult reconstruction task – in selecting which areas carrying out entire off-site reconstruction to investigate, analyze, and report on. The areas selected were New Beichuan County, Zhuyuan New Zone of Qinchuan County, and Hanwang Town of Mianzhu City.

The team systematically analyzed reconstruction in Beichuan, Qingchuan, and Hanwang to understand the improvements to living conditions for local residents, the greater equalization of public services, the strengthening of infrastructure, the protection of the natural environment, the preservation of history and culture, and the creation of a "spiritual homeland,"[2] as well as other tasks.

Based on this research, the report specifies six "best practices" in off-site reconstruction, namely, scientific and cautious site selection, integration of urban and rural reconstruction, improvement of city and town systems, emphasis on industrial development, preservation of history and culture, and safeguarding of the public's interests. It also points to some problems that arose during the reconstruction work, including initial misjudgments in planning, insufficient attention to the risk of secondary disasters, and insufficient functional agglomeration in newly built cities and towns. Finally, the report makes policy recommendations designed to guide off-site reconstruction in the future. It calls for properly resolving government debt in postquake reconstruction, creating a favorable environment for industrial development, paying close attention to and improving town administration, and stepping up efforts to promote job creation and poverty relief.

The experiences, problems, and recommendations presented in this report not only provide significant guidance for China's postearthquake reconstruction work in the future, but also serve to introduce China's experience with postearthquake reconstruction to the global community as part of an overall effort to facilitate disaster reduction and postdisaster reconstruction.

1 Off-site reconstruction of an entire county or town may occur in one of two ways: it either requires adjustment of administrative planning or does not require any adjustment.

2 The spiritual homeland is a series of sites for both earthquake memorials and mental health services for victims.

The report is divided into five chapters. Chapter 1 addresses conditions prior to the earthquake and describes damage and losses from the earthquake. Chapter 2 discusses the basic conditions of off-site reconstruction planning. Chapter 3 deals with the progress of the reconstruction work. Chapter 4 sums up the basic experiences of off-site reconstruction. Chapter 5 describes the problems arising from reconstruction and offers policy recommendations for the future.

# 1

# Conditions before and after the Wenchuan Earthquake

This chapter summarizes the pre-earthquake conditions of the three places – Beichuan, Qingchuan, and Hanwang – that form the basis for this report. It looks at resident composition, economic and social development, natural resources, environmental carrying capacity, and history and culture. It also describes the earthquake's effects on each place, including casualties, property losses, and impact on economic and social development.[1]

## Conditions before the Earthquake

Situated on mountainous terrain, the counties of Beichuan and Qingchuan receive state poverty relief and exhibit relatively backward economic and social development. Hanwang Town of Mianzhu City is an important traditional industrial town and has a relatively good basis for economic and social development.

### Beichuan County

The only Qiang autonomous county in China, Beichuan County is located in the transition area between the Sichuan Basin and the plateau; it has 20 towns and 278 administrative villages under its jurisdiction. Before the earthquake, it had a population of 161,000 people, 57 percent of them members of the Qiang ethnic minority. The area was also home to 16 other ethnic groups, including Tibetan, Hui, Miao, Zhuang, and Yi. In 2007, it had a gross domestic product (GDP) of Y 1.2 billion, a GDP per capita of Y 8,598, and fiscal revenue of Y 51 million. The county town was located in Qushan Town before the earthquake.

### Qingchuan County

Qingchuan County is situated along the north border of the Sichuan Basin, on the lower reaches of the Bailong River, at the junction of Sichuan, Gansu, and Shaanxi Provinces – the intersection of central and west China. Sometimes called the "Gold Triangle," it was said of Qingchuan that "a cock crowing there could be heard in three provinces." There are in total 9 towns, 27 counties, and 268 administrative villages under its jurisdiction, inhabited by 10 national minorities: Tibetan, Man, Moggol, Miao, Zhuang, Dongxiang, Korean, Tujia, Hui, and Qiang. In 2007, its GDP amounted to Y 1.378 billion; its per capita GDP was Y 6,107 and its fiscal revenue was Y 17 million. Before the earthquake, its county town was Qiaozhuang Town.

1 The data in this chapter and in the report as a whole are from the Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction in Beichuan Qiang Autonomous County and from materials provided by the Sichuan Province Department of Finance.

### Hanwang Town of Mianzhu City

Under the administration of Deyang Mianzhu City, Hanwang Town is on the border of the north-central Sichuan Basin, situated at the upper reaches of Mianyuan Lake, in the alluvial fan at the foot of the Longmen Mountains. In this established industrial town, the phosphorus chemical industry is a characteristic and advantageous industry; other main industries include mechanical processing and mine excavation. Construction (engineering and materials) is an advantageous industry. In 2007, its total industrial output value was Y 13. 1 billion, its fiscal revenue was nearly Y 300 million, and its GDP was Y 3. 78 billion. Mechanical processing industries, led by Dongqi Co., Ltd., are local pillar industries, accounting for over 80 percent of local GDP.

## Damage and Losses from the Earthquake

Beichuan County, Qinghcuan County, and Hanwang Town of Mianzhu City were extremely hard hit by the Wenchuan Earthquake. They suffered a huge number of casualties, extremely serious property losses, and devastating damage to infrastructure and industries.

### Damage and losses in Beichuan County

Beichuan County suffered the worst damage in all of China as a result of the Wenchuan Earthquake. The earthquake affected 161, 000 people in Beichuan, killing 15, 645 and leaving 4, 311 missing – in combination one-eighth its total population. Among those killed or missing were 436 officials, 22. 8 percent of the total number. Another 26, 916 people were injured. Direct economic losses in the county amounted to Y 58. 57 billion. In the old county town of Beichuan, 80 percent of buildings collapsed and only about 4, 000 of the total 10, 000 residents survived. The earthquake also left nearly 30 villages in the county covered by landslides and mudslides; it destroyed infrastructure such as roads, bridges, electricity supply, communications, and water supply; and it severely damaged 360 high-revenue (above-scale) enterprises.

### Damage and losses in Qingchuan County

In Qingchuan County, the Wenchuan Earthquake killed 4, 697 people, left 124 missing, and injured 15, 479. Student dormitories at Muyu Middle School collapsed during the earthquake, and more than 300 students were buried by the debris. Landslides buried Donghekou village and over 780 residents under rubble 100 meters deep. The Qingzhu River was blocked to form an 18-meter-deep barrier lake. Among the buildings that collapsed were dormitory buildings for the Shenzhen market and Qingchuan Hospital of Traditional Chinese Medicine as well as the Dongqing Hotel, the Qingchuan Financial Bureau, and offices of the Qingchuan government. Qiaozhuang Town, Muyu Town, and six other towns suffered extremely heavy losses; 250, 000 people were left homeless. Infrastructure such as electricity, water, gas and oil supply, road transportation, and communication facilities were all cut off.

### Damage and losses in Hanwang Town

In Hanwang Town, where the earthquake's intensity was X (10) degrees, 4, 000 people were killed and over 10, 000 were injured. Housing was extremely hard hit, with 98 percent of houses accommodating the town's 13, 360 residents either collapsing or suffering other serious damage. All infrastructure, including electricity, water, gas and oil supply, road transportation, and communications facilities were severely damaged. All industrial and mining enterprises, including Dongfang Turbine Co., Ltd., suffered great damage and suspended production.

# 2

# Planning for Off-Site Reconstruction

This chapter describes the planning for off-site reconstruction, including planning guidelines, basic principles, project contents, and implementation guarantees as well as correction, supplementation, perfection, and amendment of the plan.

## New Beichuan County

### City positioning

The guidelines for planning of off-site reconstruction followed the requirements set by the Chinese Communist Party Central Committee (CCPCC) and the State Council. These guidelines called for "building a good Beichuan" and "recreating a new Beichuan" to embody the spirit of urban construction, defiance of earthquakes, and protection of cultural heritage. They embraced a science-based approach that put the needs of people first; that sought all-around, coordinated, and sustainable development; that took all relevant factors into consideration; and that actively promoted a harmonious socialist society. Postquake reconstruction was intended to proceed quickly and to satisfy the urgent needs of the general public in quake-hit areas by distributing benefits to middle-income and low-income groups, supporting the disadvantaged, and maintaining social stability.

The reconstruction work was guided by the Urban and Rural Planning Law of the People's Republic of China, (2007.10) as well as by the following regulations, policies, and planning documents issued by the Ministry of Housing: Urban Planning Law of the People's Republic of China, Rules on Urban Planning Compilation (2006.4), Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction (2008.9), Town System Planning of Mianyang City Recovery and Reconstruction after the May 12th Wenchuan Earthquake (2008.7), Standard of Urban Land Categorization and Planning Construction Land (1990.7), Measures for Administration of Urban Blue Line (2005.11), Measures for Administra-tion of Urban Yellow Line (2005.11), Measures for Administration of Urban Purple Line (2003.12), and Measures for Administration of Urban Green Line (2002.9).

The reconstruction plan specified the following scope for off-site reconstruction of New Beichuan County: It was to be bounded by the eastern border of Hot Spring Village and Dongyu Village and the western side of Shuimo Lake in the east; by the western borders of Changle Village and Hongyan Village and the ridge line of the western and southern sides of Xunlong Mountain National Geological Park in the west; by the southern borders of Changle Village, Hongqi Village, and Dongyu Village in the south; and by Bamayan Bridge and the mountain border from Yangjia Mountin to Yangjia Yard in the north.

The new county town was to be the political, economic, and cultural center of the administrative region of Beichuan County, the western Sichuan tourism service base, the west Mianyang industrial base, and a modern Qiang cultural city. As the regional tourism service center and Mianyang's holiday resort base, the new county town's social public service functions were to be highlighted, and it was also to form an industrial base with characteristics typical of Beichuan. The population size of the new county town was to be 30,000 in 2010, 50,000 in 2015, and 70,000 in 2020. The land area for construction was to be 3 $km^2$ in 2010, 6 $km^2$ in 2015, and 7 $km^2$ in 2020.

**Construction goals, 2008 – 2010**

*Resettlement of residents*

To give priority to resettlement of affected residents of the former Qushan Town, arrangements were to be made for farmers having lost their farmland within the Beichuan County jurisdiction to be resettled within the construction region for the new county town. Efforts were also to be made to ensure resettlement of personnel in county administration institutions and attract a small number of migrants. Housing construction was to consist mainly of low-rent housing and low-income housing and was to be carried out with synchronous construction of supporting services and facilities.

*Recovery of functions*

Reconstruction was to focus on recovery of living, medical, educational, commercial, cultural, and administrative functions in the county and to ensure preliminary public services in the administrative region of Beichuan County.

*Initiation of industrial park area construction*

In the 1.4 $km^2$ industrial park area, work was to be completed on water supply, water drainage facilities, electricity supply, communications facilities, road transportation facilities, natural gas supply, heat supply, and road-surface leveling; Shandong Province was to assist in construction. Labor-intensive industries (such as agricultural product processing, textiles and clothing, and new construction materials) were to be transferred to the area in accordance with the labor force and skills present in Beichuan County. Mechanical, high-tech, and other industries relevant to industrial system development in Mianyang were to be followed with interest. Skill training for affected villagers was to be carried out on a large scale, and enterprises based in the industrial park were to be encouraged to employ the labor force in Beichuan.

**Construction goals, 2012 – 2015**

*Gathering of population*

In order to gradually increase the population, residents of Beichuan's mountainous area were to be encouraged to migrate to the new county by offering vocational training and education.

*Perfection of functions*

The industrial park area was to be stably operated and the industrial development pattern properly adjusted. The tourism service function was to be strengthened; the tourism reception facilities were seen to need further improvement in order for the featured business street to gain popularity.

*Characteristic highlights*

The reconstruction aimed to form main street blocks on a moderately large scale of, to further develop the functions of part of the city near the lake, and basically to create a stylish-looking city.

**Construction goals, 2016 – 2020**

*Modeling development*

As the only Chinese city to be entirely

reconstructed after the Wenchuan Earthquake, the new county town was to act as a model for development of small Chinese cities, both by further pioneering and by sharing its experiences.

*Extending functions*

The reconstruction was to include further development of tourism, tourism reception facilities, and national cultural industries. Reconstruction was expected to enhance the comprehensive ability of the new county town to manage regional tourism resources, to expand coverage of tourism reception and comprehensive services, and to realize the county's urban function as a regional tourism reception center. Reconstruction was also to perfect development and construction of the industrial park, to reorganize industrial land, and to carry out industrial upgrading in order to achieve the city's overall development goals.

*Serving neighboring areas*

On the basis of a relatively sound social service system and relatively large industrial system, the new county town was expected to continue promoting comprehensive social and economic development in Beichuan County, to satisfy the requirements of regional overall development, and to further promote development of neighboring areas through effective policies and measures.

**Urban spatial function and structure of the new county town**

The plan adhered to intensive and economical land use and achieved compact development while realizing urban functions and ensuring safety. Proper use of shallow hills and mountainous regions was intensified. Within the city, layout of land use for various functions was rational and convenient. Along the central area and main streets, land use for important urban public service utilities was arranged; in areas near water, with good air circulation and scenic views, residential land was arranged; and in lower-wind and side wind areas, industrial land was arranged.

The construction of the new county town featured multistory and low-story buildings, while multistory factories were advocated in industrial areas. Plot ratio and building density were controlled in accordance with corresponding construction size, and their effects on city appearance were taken into consideration.

The population size of the new county town was expected to be 70, 000 people, and the final land area for construction was to be 7. 14 $km^2$, making construction land per capita 102 $km^2$.

Figure 2. 1 shows the natural and geographic conditions, as well as the location, of the site selected for New Beichuan County.

**Planning implementation**

*Step-by-step implementation*

Implementation of the reconstruction plan took place phase by phase and step by step. In accordance with the requirements of phased construction under the master plan, each relevant department formulated corresponding planning, determined the construction focus of each phase, and carried out construction in the order called for.

*Planning evaluation system*

The Expert Evaluation Committee of Urban Planning was created to ensure oversight of the construction process. Committee members were charged with annually examining and verifying each planning item and with calling for adjustments based on practical construction status.

*Land use management policy*

The land use management policy took the master plan as the fundamental basis for urban land use management. The implementation of centralized and uniform

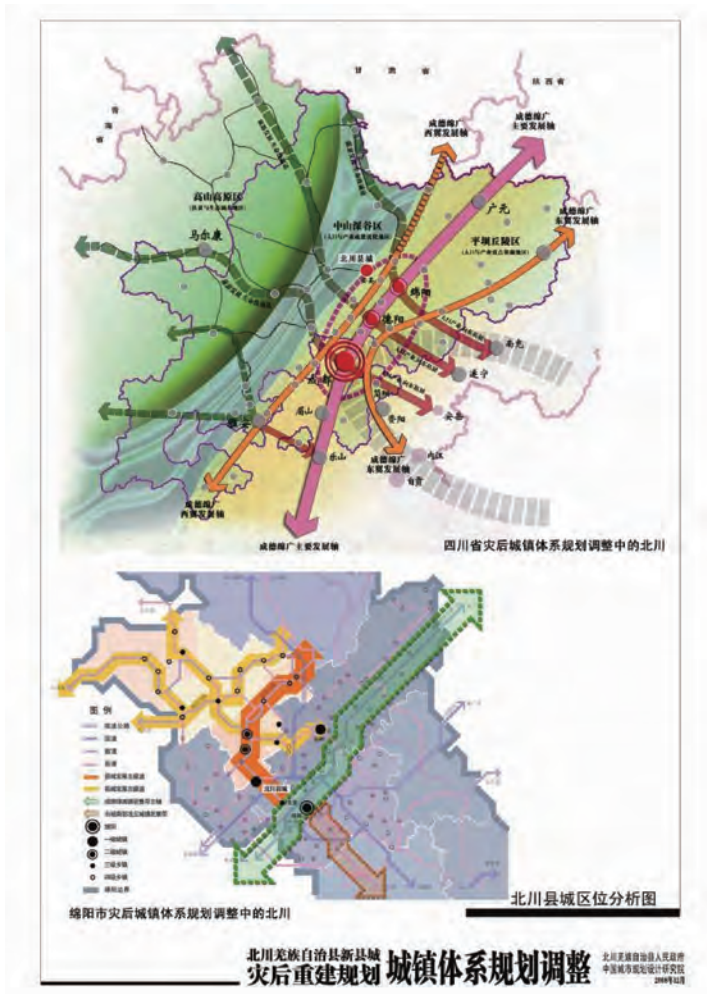


**Figure 2. 1. Map of New Beichuan County (in Chinese)**
Source: Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction of Qiang Autonomous County in Beichuan.

management measures for land was intensified, and requirements for development control of various land uses were strictly managed. In the reconstruction project base, for construction projects requiring large amounts of land, land use was directly specified in the planning; for reconstruction projects without need for independent land use, combined arrangements were considered, and this approach was reflected in the specific planning and construction process. Control and management of industrial land transfer was intensified by setting up access criterion so as to improve industrial land development intensity and land use efficiency.

*Human development policy*

The plan's human development policy offered preferential policies to affected residents, properly arranged for their resettlement, and maintained social stability. The policy expanded the scope of vocational skills training for the rural labor force in order to provide a labor force guarantee for development of the industrial park, to gradually improve residents' income, and to facilitate coordinated development of towns and villages in the administrative region of Beichuan County.

*Establishing a modern planning administration system*

With support from a geographic information system (GIS) and other technologies, relevant business resources for planning administration were integrated, and an information resource system for planning administration was built, characterized by centralized storage management and dynamic update. The system also allowed for automatic planning compilation management, deliberation and approval of construction project planning, postapproval planning administration, and other planning administration business.

*Regional coordination policy*

The regional coordination policy (specifically involving towns in Anxian County such as Huangtu, Huagai, and Sangzao as well as Mianyang City) intensified coordination on matters such as industrial division and cooperation, infrastructure sharing and connection, water resource management, disaster prevention, and environmental governance, among others.

*Department coordination policy*

A mechanism was established to link departments involved in urban planning, development, and reform with land management, construction management, and other relevant departments. The mechanism also reinforced the connection between overall urban planning, professional planning, and daily management work of other departments, and it promoted orderly implementation of all work related to construction of the new county town. To ensure a legal, fair, and efficient planning implementation, the urban management system, including inspection and approval procedures, was administrated in accordance with relevant laws and regulations.

*Public participation policy*

Under this policy, the supervision and inspection system for urban planning was improved; an inspection role in urban planning implementation was realized for the National People's Congress, the Chinese People's Political Consultative Conference, each primary community and social group, and the general public; a policy research mechanism and expert validation system were established for significant issues; an announcement and hearing system was established for key construction projects; the transparency and credibility of the urban master plan was improved; and an inspection mechanism was set up to involve public participation in each phase of planning compilation and management.

*Guarantee mechanism*

The policy guarantee grows out of two 2008 documents, Suggestions for Policies Supporting the Post-Wenchuan Earthquake Reconstruction, by the State Council, and Suggestions for Policies Supporting the Post-Wenchuan Earthquake Reconstruction, by the Sichuan provincial government. These two documents specify preferential fiscal policy, taxation policy, financial policy, industry support policy, land and mineral resource policy, employment and social security policy, and grain policy intended to promote postearthquake reconstruction.

The plan guarantee, based on the State Council's Overall Plan for Post-Wenchuan Earthquake Recovery and Reconstruction, was put forward by the Sichuan provincial government. It made the planned project more detailed – it included 218 planned projects in New Beichuan County for a total investment of Y 11 billion – and set up an annual investment task to make the source of funds clearer.

The funds guarantee arises from the specific funds for reconstruction established by finance departments within the central government, the Sichuan provincial government, and the governments of Mianyang City and Beichuan County. As the donor province under the "twin assistance" mechanism, Shandong Province was to provide more than 1 percent of its fiscal revenue for Beichuan reconstruction for three years in a row. Beichuan County was also to use substantial funds from Hong Kong SAR and Macao SAR, donation funds, and special party membership dues. Moreover, significant bank funds and social capital were attracted to the reconstruction in the form of discounting and guarantees. All of these methods were to ensure that funds for reconstruction were available.

## Zhuyuan New Town of Qingchuan County

**General provisions of planning**

The planned scope of reconstruction involved part of the Zhuyuan Town area of the Zhuyuan Economic and Development Zone, including Huangshaba Industrial Zone, Chengjiaba and Zhuyuanba Old Town Zones, Liangshaba New Zone, Shijiaba Wisdom Island, and Beiya Industrial Zone, amounting to an area of 12. 8 $km^2$.

The reconstruction work was guided by the following regulations, policies, and planning documents: Urban and Rural Planning Law of the People's Republic of China (2007. 10); Code of Urban Residential Areas Planning and Design (GB50180-93); Postdisaster Reconstruction Urban System Planning in Administrative Region of Guangyuan City (2008 – 2010); Qingchuan County of Sichuan Province Urban System Planning (2008 – 2010); Master Plan of Zhuyuan Town, Qingchuan County, Sichuan Province (2008 – 2020); Regulatory Plan of Beiya, Dongba, and Taba in Qinchuan County Zhuyuan Economic and Development Zone; Regulatory Plan of Qingchuan County Zhuyuan New Zone (2009. 12); Regulatory Plan of Chengjiaba and Zhuyuanba of Zhuyuan Town (2009. 9); and a topographic map of planning scope and other relevant information provided by Qingchuan County (figure 2. 2).

The guidelines for off-site reconstruction called for applying a scientific outlook to development, putting people first, and showing respect for nature; they also called for attention to safety, function, and beauty and emphasized a fact-based approach that would adjust in accordance with local conditions and highlighted characteristics.

The goal of planning was to build Zhuyuan as the economic center of Qingchuan County, as a model district for new industrial development, and as a cultural education base.

**Status overview**

Situated on the southern border of Qinchuan County with the Qingzhu River flowing across it, the administrative region of Zhuyuan Town forms a wide U-shaped valley that covers an area of 59. 99 $km^2$. The terrain starts high in the northeast, ends low in the southwest, and has a strip-shape clustering distribution along the river. Neighboring mountain ranges are over 1, 000 m high and about 500 m higher than the river valley, where the terrain is moderately mountainous.

The town is on the southern border of Qingchuan County, around 80 km from Qiaozhuang Town in the same county and 6 km from the Jinzi Mountain entrance to Mianyang-Guangzhou Highway. The 38 km Baoji-Chengdu railway line runs across the town.

The scope of planning for land use in Zhuyuan Town involves a total area of 11. 8 $km^2$; of this, 1. 5 $km^2$ has been built on, or 13 percent of the total area. Construction land per capita is 105 $m^2$ per person. The undeveloped land is 10. 3 $km^2$, including 2 hectares of water. The town has

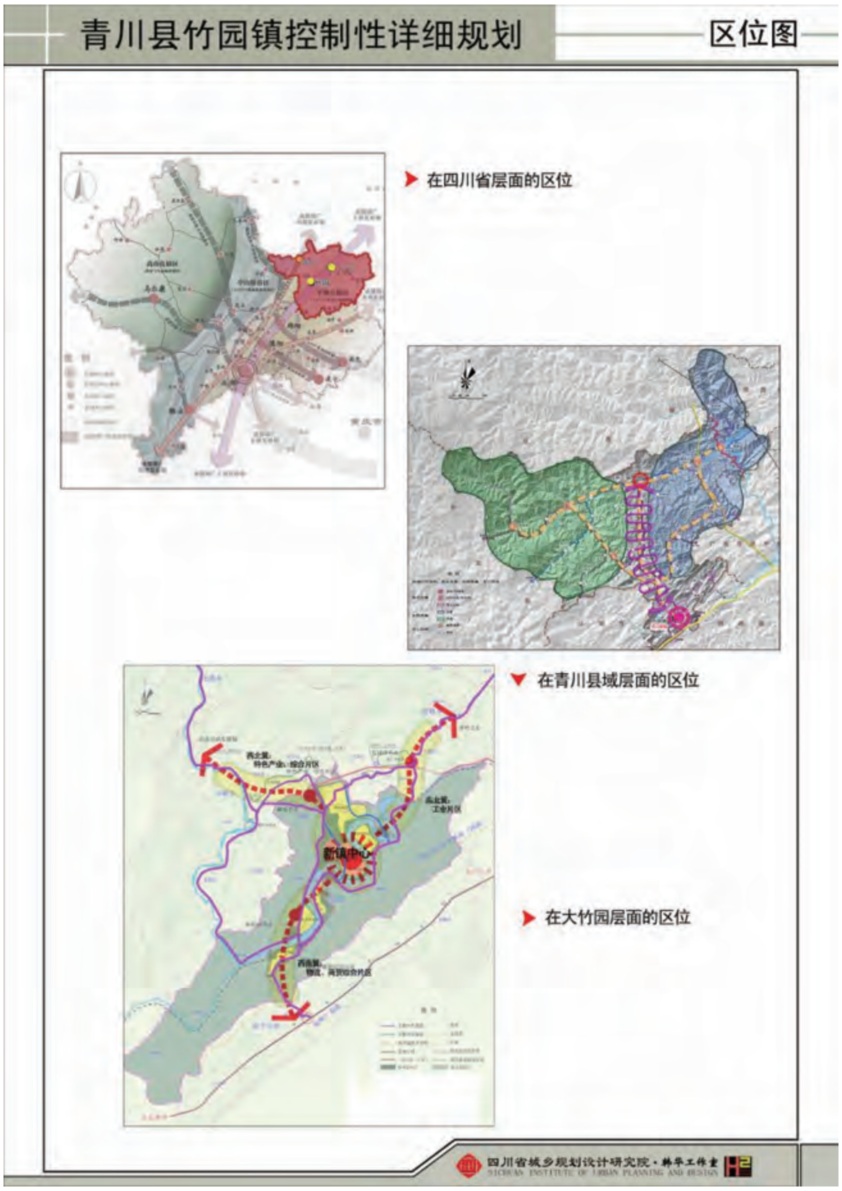


**Figure 2.2. Map of Zhuyuan Town, Qingchuan County (in Chinese)**

Source: Regulatory Plan of Qingchuan County Zhuyuan New Zone.

an elevation of between 485 m and 550 m; the two sides of the river valley it occupies gradually rise to 1200 m. Concerning flood control, the width of the Qingzhu River discharge section is controlled at 230 m. Concerning geological structure and risk, Zhuyuan Town is in the fault area of Longmen Mountain, but not in the two main active fault zones in Qingchuan County. The area therefore has a relatively low risk of disaster, though collapse, landslide, and mud-rock flow are posible.

In 2009, the registered population of Zhuyuan Town was 14,607; 6,520 of these were urban residents and 8,087 were rural residents. There were an additional 2,300 migrating temporary residents. After 1,281 people left the town, the town's administrative region had a total of 15,626 residents.

Two further issues to be taken into consideration in reconstruction were these: First, the Qingzhu River connects a series of six land use function clusters in Zhuyuan Town – from south to north, they are Huangshaba, Zhuyuanba, Chenjiaba, Shijiaba, Liangshaba, and Beiya. Second, there are three comprehensive areas in Zhuyuan that integrate administration, commerce, living, and logistics; they are Chengjiaba, Zhuyuanba, and Huangshaba. Shijiaba and Liangshaba are in the new area reconstructed after the earthquake.

**Requirements of host planning positioning and relevant planning**

Three key planning documents laid out the requirements for reconstruction of Zhuyuan. The first was Town System Planning of Qingchuang County, Sichuan Province (2008 – 2020). It identified Zhuyuan Town as the primary central town of Qingchuan County and specified its location. The second, the Master Plan of Zhuyuan Town (2008 – 2020), indicated that an urban structure of "one water system, two mountains, and six clusters" should be built. The third, Development Planning of Zhuyuan Economic and Development Zone in Qingchuan County, Sichuan Province, indicated that the total planning area of Zhuyuan Economic and Development Zone was 21.58 $km^2$, of which construction land accounted for 12.15 $km^2$, industrial land 6.8 $km^2$, and land for supporting functional buildings (including a hospital, a school, housing, and buildings for commercial logistics) around 3.5 $km^2$.

The goal was to build Zhuyuan Town so that it would be to Qingchuan what Shanghai is to China – a bustling showplace with a thriving economy. Great efforts were to be made to develop industry, build an industrial park with an industrial output of tens of billions yuan, construct a small modern city, and establish county-level educational institutions to turn the town into the economic and social center of Qingchuan County. On the basis of planning by high levels of government, research should be conducted on issues such as logistics, transportation, supporting industries, and housing and resettlement; difficulties encountered in project implementation in the Beiya Industrial Area will be resolved, with the old supporting facilities being improved, and the new area constructed.

## Hanwang Town of Mianzhu City

**Planning basis and phases**

The reconstruction work on Hanwang Town was guided by the following regulations, policies, and planning documents:

Urban and Rural Planning Law of the People's Republic of China, Recovery and Reconstruction Rules after the Wenchuan Earthquake, Opinions of the State Council on Policies and Measures of Supporting Recovery and Reconstruction after the Wenchuan Earthquake, Compilation Measures for Urban Planning, Standard for Urban Land Use Categorization and Planning Construction Land, Guiding Opinions on Compilation Work of Urban Recovery and Reconstruction Planning after the Wenchuan Earthquake, Opinions of Sichuan Provincial Government on Support for Policies and Measures of Recovery and Reconstruction after the Wenchuan Earthquake, Town Planning Standard, Regulations for Mianzhu City Urban Planning Administration Technology, State Master Plan of Recovery and Reconstruction after the Wenchuan Earthquake, Mianzhu Urban Master Plan, Mianzhu Village System Planning of Recovery and Reconstruction after the Wenchuan Earthquake, District Planning of Hanwang Town of Mianzhu City, and Master Plan of Wudu Town.

The local government provided fundamental postdisaster information on population, land use, economy and society, earthquakes and other geological disasters, flood control, issues posed by underground cavities, and local planning of postdisaster recovery and reconstruction.

The Hanwang Town reconstruction work was to occur in three phases; immediate-term work, in 2008; short-term work, from 2008 to 2010; and work over the long term, from 2011 to 2020.

Figure 2. 3 shows the natural and geographic conditions, as well as the location, of the site selected for Hanwang Town in Mianzhu City.


**Figure 2. 3. Map of Hanwang Town (in Chinese)**

Source: Master Plan of Hanwang Town of Mianzhu City.

**Town administrative region planning**

The town administrative region had an area of 79. 8 $km^2$ and encompassed 11 administrative villages and 126 villager groups. Its total population amounted to about 65, 000, including 35, 000 town residents, 27, 000 rural residents, and 3, 000 permanent immigrants. At the end of planning, the total population of the town administrative region was to be controlled at 55, 000, including 30, 000 town residents and 25, 000 village residents. As of 2010, the total population in the town administrative region amounted to 55, 000: 23, 000 permanent residents who had migrated to the new town, and 32, 000 resettled residents in the village region. The short-term urbanization level was established at 41. 8 percent and the long-term urbanization level at 54. 5 percent.

The development strategy of the town administrative region was designed to realize phased development and orderly transition. To promote overall development, reconstruction was to foster tourism and ecological development. To promote economic development, the tourism industry was to be integrated and enhanced, the high-tech industry was to be developed, and processing of agricultural and sideline products was to be further developed. To promote proper spatial development, the center was to be resettled and reconstruction to occur at a different site; development was to conserve resources and be environmentally friendly.

Requirements for spatial control in the town administrative region took the following into consideration: the possibility of geological disasters (mudslide, landslide, and collapse), impact of a potential earthquake fault area, safety of flood control facilities, ecological safety, and construction feasibility (elevation and slope). Based on these requirements, the town region was divided into a construction-forbidden area, a construction-restricted area, and a construction-suitable area.

**Function positioning and town size**

The town was to be reconstructed as a comprehensive tourism location surrounded by mountains and water. It contained important monumental relics of the Wenchuan Earthquake and was to become an important tourism spot town in west Sichuan, the northern gateway to Mianzhu City, a tourism distribution center, and a commercial and material distribution center.

The population of the town proper (as distinct from the town administrative region) was to be 23,000 in 2010 and 30,000 in 2020. Until 2010, land use was to be 2.43 $km^2$, with 105.63 $m^2$ per capita; by 2020, it was to be 3.43 $km^2$, with 114.31 $m^2$ per capita.

**Guidance on new and old town region construction**

Guidance on Hanwang Town construction distinguished the new town region from the old town region. The old town region was to be divided into an earthquake memorial and reconstruction area, and the new town region was to be divided into a new-construction area and area for industries and long-term development.

In the old town region, the core area of about 1.0 $km^2$ was to be the earthquake memorial. In the new town region, the new construction was to occur in the space enclosed by De'a Road and Mianyuan Lake, with an area of 2.0 $km^2$. The industrial and long-term development area was to be located at the lower-wind side (to the south) of the new town. About 0.6 $km^2$ in area, this section is enclosed by Guanyan, Yuanxing Road, Hanxiang Road, and De'a Road and integrates ecological recreation and tourism, relics, the Yunwu Temple and Jixiang Temple, and typical western Sichuan characteristics.

The town's spatial organization was to make full use of the five water systems in the town region; the goal was to construct an ecological and aesthetic framework of a "constant flowing stream," and to form a layout concept of a "constant flowing stream within an ecological town." This layout was further to reflect the concepts of "sustainable development of an ecological town, transmission of the spirit of earthquake defiance and disaster relief, and ongoing development of Hanwang Town."

**Land use layout planning**

The overall urban layout structure was to include "two streets, two centers, seven quarters, and an industrial centralization district." The two streets are Hanwang Street, a tourism and resort street of the town, and Hanling Road, the main street connecting the residential and production areas of the town. The two centers are the town public center and the recreation service center for tourism and other activities; the former was to be located where the two streets converge and the latter at entrance to the reconstruction area. The seven quarters are Qingxi Quarter, Liangxi Quarter, Yuxi Quarter, Xiangshang Quarter, Guanshan Quarter, Wangjiang Quarter, and Hanxing Quarter. The industrial centralization district was to be in the southern part of the town region.

The town region was planned to have a land use of 388.75 hectares, of which 342.94 hectares, or 88.2 percent, would be for construction.

# 3

# Progress of Off-Site Reconstruction

After the Wenchuan Earthquake, the special nature of off-site reconstruction made for especially arduous and complex recovery and reconstruction tasks. This chapter describes how reconstruction progressed at the different sites, with a focus on planning implementation results ( that is, project construction progress), economic and social effects, fund raising and use, and the making and implementation of policy.

## Improvements in Housing Conditions for Residents

During the off-site reconstruction, resolution of residents' housing problems was given the highest priority. At the three reconstruction sites, eight low-income housing projects were built, for an investment of Y 3.58 billion, and low-income houses were built for 21,529 households including nearly 80,000 people. The new houses had a more rational layout, better functions, more supporting facilities, and a higher standard of seismic-shock resistance than the old.

## Improvements in Public Service Level

At the three reconstruction sites, 18 schools were built and all students removed from temporary dormitories. Ten medical and health care facilities and 31 social welfare facilities, old-age homes, community service centers, recreation and sports sites, and trade markets were also built. Building safety was strengthened, the quality of facilities and equipment improved, and public service ability significantly improved. The equalization level of basic public services jumped to become among the best in western China.

## Improvements in Infrastructure

A large number of key infrastructure projects bearing upon long-term development in disaster-affected areas was built, the framework of the town was put in place, and the main functions of the town were completed. The road network took basic shape, and transportation quality was greatly improved; reconstruction of key electricity networks, including the rural electricity network, were completed; and water sewerage, sewerage treatment, radio and television, postal service and communications, and other infrastructure were completed as well. A new disaster prevention and escape sanctuary was built, and the disaster prevention and reduction ability of the town was greatly improved.

## Industrial Recovery and Growth

Enclave Industrial Park, Recycling Economy Park, and Lianjian Industrial Park were built in succession, and a large number of competitive enterprises have moved in. Remarkable progress was made in industrial transfer from the east; backward and surplus factories were sifted out, and (excepting those that left following the earthquake) all disaster-damaged enterprises in the affected areas have restored production – some even set new records in production and operation. Primary industry, along with tourism and related industries, grew following reconstruction.

### Improvements in Ecological Environment

During the process of off-site reconstruction, ecological and environmental protection was emphasized, and the natural surroundings were used to create an urban environment that included mountains and water as well as typical city features. In New Beichuan County, an ecological corridor was established in the Anchang River valley, and a strip-shaped city park built to take advantage of the existing water system. In Zhuyuan Town in Qinchuan County, the water system and related geologic features were used to build a public green space, and mountains that couldn't be built on were used as part of an urban green park. In Hanwang Town, the five water systems flowing through the town were the basis for the town's ecological and aesthetic frameworks.

### Protection and Preservation of Ethnic Culture

During the process of off-site reconstruction, the focus on protecting and preserving ethnic culture helped to create an "earthquake culture" and to shape a new style of town.

For the new county town in Beichuan County, three styles were drawn on – the area's original style, another style that retained the essence of the area's culture, and a modern style – and both Qiang nationality features and Han-Qiang features were used. Efforts were made to balance use of local and ethnic characteristics with economic considerations. The functions and features of urban construction were partly designed to convey ethnic history and cultural information.

In Hanwang Town, protective development was carried out for religious cultural tourism attractions, such as the Yanxian Taoist Temple, the Jixiang Temple, and the Yunwu Temple, and for state-level intangible cultural heritage, such as the Mianzhu new-year paintings and Jiannanchun spirit culture.

At all three reconstruction sites, earthquake relics were protected. The Beichuan Earthquake Relics Protection District and Museum, the Hanwang Earthquake Industrial Relics Protection District, and the Qingchuan Lianghekou Earthquake Relics Protection District were established to help promote the spirit of earthquake defiance, publicize disaster relief, and offer education about earthquake prevention and disaster reduction.

### Synchronous Reconstruction of Spiritual Homeland

During the reconstruction process, particular emphasis was placed on humanitarian aid. A psychological rehabilitation project – the creation of a "spiritual homeland" – was implemented in order to help relieve affected residents of the impact of the earthquake and help them to a stronger, more optimistic, and more confident outlook.

### Summary of Off-Site Reconstruction Progress

Under the firm leadership of the CCPCC and the State Council, and supported and aided by donor provinces and cities and by all social sectors, people in the affected areas have showed a spirit of self-reliance and willingness to work hard, and have made extraordinary efforts to overcome difficulties and setbacks. They have successfully accomplished postdisaster reconstruction goals and tasks set up by the CCPCC and the State

Council. After three years, reconstruction of the new county town of Beichuan County, the new Zhuyuan Town of Qingchuan County, and Hanwang Town of Mianzhu City is complete.

The urban functions of the three places have been formed; facilities have been put into operation; and residents are resettled and starting a new life. By the end of September 2011, 298 items in the 10 project categories included in state planning at the three sites, or 100 percent of reconstruction tasks, had been begun; and 293, or 98. 3 percent, had been finished. Accumulated investment totaled Y 18. 9 billion, or 97 percent of total planned investment.

# 4

# Experiences of Off-site Reconstruction

During two years of reconstruction, efforts were made to balance speed and quality, recovery and progress, present and long-term development. This chapter describes key experiences of off-site reconstruction, including choice of reconstruction mode, integration of rural and urban areas, progress of industrialization, and the building of a new socialist countryside – one that is prosperous, economically well developed, and harmonious. It also includes some new solutions for reconstructing the security system and the mechanism that ensures effective functioning of work procedures and rules.

## Importance of Scientific Site Selection in Off-Site Reconstruction

Because the primary issue in off-site reconstruction is safety, three principles to ensure safety guided site selection in the reconstruction process. Firstl locations near the earthquake fault zones were avoided. Second, locations at risk of other geologic disasters (including secondary disasters) were also avoided. Third, site selection took into account the need for sufficient flood discharge room. Adhering to these principles ensured that the new sites would not suffer earthquakes, other geologic disasters, or floods.

**Site selection for New Beichuan County**

After the earthquake, the Beichuan County government administered a public opinion poll on off-site reconstruction to the residents of Beichuan County and Anchang Town. The results showed that 95.29 percent agreed that reconstruction should take place off site, and only 1.36 percent held the opposite opinion. As for the new site, about 88.55 percent of residents wanted to move to flatland, while 4.38 percent preferred to stay in the mountainous area. For 60.19 percent, safety was the top concern; the next-largest share was most concerned about a source of clean water.

Immediately after the earthquake, the China Urban Planning and Design Institute started to select the new sites. There were five possible sites for reconstruction of Beichuan: the southeast part of Anchang Town, Leigu Town, Yong'an Town, Anchang Town in its entirety, and Sangzhao Town. Through careful investigation and comprehensive evaluation, the China Urban Planning and Design Institute chose the plan for the southeast part of Anchang Town as optimal.

The plan was chosen for the following reasons: First, the site was very safe, with appropriate geographical conditions, landform, and hydrology. Second, it offered enough space to meet the requirements of the new city and to allow development of secondary industry and tertiary industry as well as overall development in the future. Third, the location was conveniently sited near the regional main roads and accessible to the urban area of Mianyang, making it possible for the new city to be driven by

Mianyang. Fourth, it was large enough to allow a cultural space, which would help to revitalize and preserve the culture of the Qiang ethnic group. Fifth, adjustments to the administrative setup would be minimized and administration could proceed smoothly. In November 2008, the State Council approved the site selection plan officially.

**Site selection for Zhuyuan Town in Qingchuan County**

For Beichuan County, off-site reconstruction was widely agreed upon, and the main decision involved the new site's location. For Qingchuan County, the reconstruction choice began with whether to move at all. Some experts held that although Qiaozhuang Town, the main urban area of Qingchuan County, was not located on the fault zone of the Longmen Mountains, it was on the regional fault zone, Pingwu, which had been activated by the earthquake. After the earthquake, Shiziliang Mountain, just outside Qiaozhuang Town, was split by a crack 1,500 m long and 0.5 m wide, and the fear was that this place could suffer a geological disaster at any time. Thus, some experts argued, Qingchuan County should be reconstructed off-site to avoiding being the second Beichuan.

Another group of experts, however, held that there was no fault zone in Qingchuan County and that the cost of off-site reconstruction was not justified by the small risk of rebuilding on site. This group suggested that, following the example of some developed cities in other countries, Qingchuan County be reconstructed on the original site, with earthquake fault zone areas avoided.

While the experts were arguing, Qingchuan County was hit by hundreds of strong aftershocks. A magnitude 5.4 earthquake on May 19 put Qingchun in danger: Jianqing Road, the only way into or out of Qiaozhuang, was blocked by a massive landside, and Qiaozhuang was isolated. On May 21, potential landslides in Shiziliang led to the evacuation of more than 300 people. On May 25, a magnitude 6.4 aftershock – the most severe since the May 12 earthquake – struck the area, with Qingchuan as the epicenter. Experts from the Ministry of Land and Resources and the State Seismological Bureau rushed to Qingchuan County and concluded that the aftershock had caused more damage to Qingchuan than the main shock, and that any further strong aftershock could cause a landslide. The county had to select another site for reconstruction.

The experts chose two sites for consideration, Banqiao Town and Zhuyuan Town. Near the Baoji-Chengdu Railway and Mianyang-Guangzhou Highway, Zhuyuan Town is mainly sited on flatland, with terraces and gentle slopes. The engineering geological conditions are comparatively simple, and surface and underground water is available. All of these made Zhuyuan Town a possible choice for the reconstruction. In 2009, the Sichuan provincial government officially approved the reconstruction plan that would relocate Qingchuan County in Zhuyuan Town.

In the planning of Zhuyuan Town, the emphasis was on the supporting, radiating, and driving role the urban center would play for the county as a whole. As the new center of the county, Zhuyuan Town has mainly sought the development of industries and public services. Qiaozhuang Town was retained as the center for administration according to the principle of "function reduction," and it will focus on promoting circulation of trade and commerce.

**Site selection for Hanwang Town in Mianzhu County**

Most of the residential houses and infrastructure-related buildings in Hanwang Town were seriously damaged during the Wenchuan Earthquake, and the town was in dire need of reconstruction. But it was not obvious whether to rebuild the town on the old site or change to a new site. After many arguments, the experts reached agreement on several basic issues.

First, because Hanwang Town is located beside the main earthquake fault zone of the Longmen Mountains, it is always at risk of earthquakes and other geological disasters. Second, it would be difficult to repair or rebuild the many buildings seriously damaged during the earthquake because of the massive capital and high-level technology that would be required. Third, the comprehensive adjustment fee for reconstruction on the old sites would be high. A large amount of capital in a short time would be needed for the repair of roads and bridges, reconstruction of municipal pipes and public infrastructure, and prevention of geological disasters in areas along the mountains. Fourth, dealing with the complicated property relations would be difficult. In addition to the houses that collapsed, the arable land that was destroyed, and the land forms that were changed, registration data and other records were lost during the earthquake, making it impossible to sort out claims of ownership. It would also be quite difficult to implement property policies or ensure property clearance for reconstruction. Fifth, people's need to be settled, employed, and in a stable situation was important and needed to be taken into consideration.

Based on a comprehensive geological appraisal, the town was divided into separated administrative sections designated no-building areas, limited-building areas, and building areas. The off-site reconstruction mode was adopted for reasons of safety. At the lower end of the Mianyuan River, about two miles away from the old site, the new town was reconstructed in Xiangshan Village.

### Success of site selection

The reconstruction experience of New Beichuan County, Zhuyuan Town in Qingchuan County, and Hanwang Town in Mianzhu County was generally successful. The three new towns have withstood the test of many aftershocks, mountain torrents, and debris flow, and the lives and property of the people are well protected. The original goal of site selection, which was to lay a solid foundation for the success of off-site reconstruction, has been achieved.

## Coordinated Development of Rural and Urban Areas as the Guarantee Mechanism for Off-Site Reconstruction

The off-site reconstruction of Beichuan County, Qingchuan County, and Hanwang Town involved not only the reconstruction of the "hardware" facilities, but also a process of integrating rural and urban areas for the betterment of each. This process entailed interaction between cities and countryside, extension of city functions, development of the rural economy, and reshaping of rural and urban structure.

### Interactive integration of rural and urban economies

Plans for economic development paid special attention to the cities' aggregation, radiation, and centering function and sought to develop rural areas under the lead of cities. Plans also recognized the unique features of the rural economy and sought to boost the urban economy through development of the rural. The intent was for rural and urban economies to interact with and be integrated with each other in order to realize coordinated development of different industries.

For example, Beichuan County enjoys an advantageous location near Mianyang and Anxian County. Its cooperation with Shandong Province on agriculture is increasing; Beichuan County established a high-tech agricultural park by bringing in vegetables from Shouguang County in Shandong Province. Mechanisms of this sort allow many people to become prosperous. With the help of Shandong Province, Beichuan County set up Weisite Commodity Transaction Limited Corporation, a supplier of vegetables, fruits, and other unique agricultural products that offers multiple trading modes such as online mall, listed trading of spot goods, and bidding auction trading.

The benefits of rural-urban integration are also evident in Hanwang Town, which during reconstruction developed tourism in towns and villages in a coordinated way to form a tourism industry with multiple paths, forms, and complementary modes. Through agglomeration and model effects, the pilot agricultural park in Mianzhu County has yielded more than Y 2 million and increased income by more than Y 15 million for people in rural areas. Once all the projects are underway, the revenue of the park may reach Y 5 million and drive the total income of people in rural areas to more than Y 300 million.

The three newly constructed areas also promote improvement of production conditions and innovation capacity in rural areas by promoting infrastructure construction and farm land reclamation.

**Interactive integration of rural and urban social programs**

Focusing on the unique characteristics of rural areas, Beichuan County, Qingchuan County, and Hanwang Town stressed the development of rural social programs in both hard and soft reconstruction. They aimed to elevate the level of social programs in rural areas and to achieve greater equality for rural public services relative to urban public services. During reconstruction, the three areas took a series of political measures to promote the integration of rural and urban areas. Public facilities for rural areas – such as rural education, medical services, public health services, radio and television, and postal communication – were given prominence, and rural social programs were pushed to keep pace with those in the towns.

Measures such as these have enabled the three reconstructed areas to rapidly step up the capacity of both rural and urban social programs. Reading rooms in the three areas, for example, provide access to books and the Internet, which allows people to get timely market information and sale conditions without going out of their home. This ability has greatly contributed to the development of the rural economy and the increase of income for people in rural areas.

**Interactive integration of rural and urban ecosystem construction**

The three reconstructed areas made full use of their natural conditions and of the ecological advantages of their rural and urban features; in this way they incorporated environmental protection and management into the whole process of reconstruction. Their goal was to build new towns and villages that offered beautiful scenery of mountains and rivers. They also sought to launch environmental protection and management activities and to control practices that would interfere with cleanliness and order, while also improving the look of towns and villages and residents' quality of life.

## The Urban System's Role in Successful Off-Site Reconstruction

**The importance of reasonable goals**

The preparation and implementation of the reconstruction plans in the three areas were based on the geological conditions, resource advantages, and future regional role of each. The reconstruction plans suited local conditions and were realistic about them. The development goal for New Beichuan County, for example, was that it become the political, economic, and cultural center of Beichuan, the base for travel service in western Sichuan

Province, the industry base in the western part of Mianyang, and the cultural town for the Qiang ethnic group. The development goal of Hanwang Town was that it serve as a memorial site for the Wenchuan Earthquake and become a key tourism town in western Sichuan Province, a northern gateway to Mianyang, and a tourism and commodity transaction center. The development goal of Zhuyuan Town was that it become a key town along the Chengdu-Mianyang-Guangzhou economic belt as well as the economic, educational, and industrial center for Qingchuan County and a modern small town focusing on industry.

There are five features common to the plans and goals of the three places. First, each sought to make itself a desirable place to live. Each made construction of low-income housing a priority to ensure the settlement of earthquake victims, and sought to construct public service facilities along with housing to make people's lives more convenient. The surrounding environment was also beautified with the goal of making the community more harmonious.

Second, each sought to develop its economy to increase prosperity. Each sought to create jobs, to increase people's income, and to optimize development by enhancing the level of industrial development and gradually changing the development mode. Various measures were taken to boost services for trade and tourism, and many service facilities for tourism were constructed. In addition, during reconstruction, the three areas sought to consolidate their ties with surrounding areas so that the development of the whole region could be promoted through the prosperity of the new town.

Third, they preserved their uniqueness during reconstruction. The traditional cultures of resident ethnic groups are visible, and the natural surroundings are used to advantage to create an environment combining mountains, rivers, and towns.

Fourth, they paid attention to the protection and construction of civilization and civilizing influences, and sought innovative ways to develop the society and to preserve and foster traditional and national cultures. In pursuit of these aims, they also promoted the efficient use of resources, advocated for energy saving and emission reduction, and generally endorsed a green, ecologically friendly culture. The three places also served to symbolize the spirit of overcoming the earthquake and carrying out of relief work; the new towns and counties reflect the country at its best and show the great spirit of the Chinese people.

Fifth, during reconstruction, the three areas worked hard to maintain harmony and social stability. As much as possible, people's preferences were respected and their opinions taken into consideration during reconstruction. Their needs were also addressed, for example by offering training to the labor force to improve workers' skills and by expanding the social security system to meet the needs of disadvantaged and low-income groups.

**Improvements in functions of urban areas**

In the three areas, steps were taken to restore housing and basic public services and infrastructure. Among the facilities reconstructed were low-income housing, schools, medical and health care institutions, social security institutions, entertainment and sports venues, party and government offices, water-supply and sewerage systems, sewerage disposal facilities, electricity and gas-supply systems, communications, sanitation systems, underground pipelines, emergency shelters, and equipment for fire fighting and earthquake relief.

Beichuan County solved the problem of housing for 40,000 people by constructing houses amounting to more than 425,000 $m^2$ in an area of more than 101.3 hectares along the east and west sides of the An'chang River. Among those now living in the new houses are former residents of the old town areas and people who lost their houses and farmland in the earthquake. In Hanwang Town, housing covers about 98.78 hectares and takes up 28.90 percent of the total construction area, which can accommodate 30,000 people. Seven residential areas were built using natural features (rivers and green areas) as boundaries. Of these residential areas, Liangxi is the main area for postearthquake settlement. Other residential areas offer affordable or ordinary housing. Housing layout in Zhuyuan Town follows the topographic conditions and uses decentralized living areas, mainly in the Chenjiaba, Zhuyuanba, Liangshaba, and Shijiaba districts. The planned living area is about 99.34 hectares, or 12.65 percent of the total construction area.

Improvements to public services in the three areas were significant. The standard and scale were both greatly enhanced compared with pre-earthquake levels. A new middle school, Beichuan Middle School, was funded by the Overseas Chinese Federation with Y 120 million and came into use before the new town. Qingchuan Middle School, located in new Zhuyuan Town, is now the main education center in Qiangchuan County. Some facilities not present before the earthquake have been added; these include libraries, youth activity centers, and stadiums. Some urban facilities have been improved to meet needs over the next 10 years; these include roads, water-supply and sewerage systems, and garbage and sewerage disposal systems.

**Environmental considerations and emphasis on unique characteristics**

Attention was paid to the ecosystem, energy conservation, and environmental protection during reconstruction. The greenbelt area in New Beichuan County is about 163 hectares, or about 22 percent of the construction area and 23 $m^2$ per capita, and the forest coverage rate is 46 percent. An area of about 23.17 $km^2$ with mountains and rivers forms a kind of ecological corridor and has been designated a no-building zone. In Zhuyuan Town in Qingchuan County, greenbelts have been constructed near roads, riversides, and residential areas; the planned greenbelt areas are 112.61 hectares, or 14.33 percent of the total construction area; this amounts to 23.81 $m^2$ per capita. Of the planned greenbelt areas, the public greenbelt is about 79.29 hectares, or 10.09 percent of the total construction area; this comes to 18.88 $m^2$. In Hanwang Town, the river system covers 6.28 hectares, or 1.6 percent of the total construction area. In New Beichuan County, environmentally friendly bicycles make up a significant share of traffic, and use of CNG (compressed natural gas) buses has started to reduce energy consumption. LED technology has been adopted in the public lighting system, which greatly reduces energy consumption, and various water-saving methods are in use to reduce water consumption and sewage discharge. Strict limits on enterprises with high energy-consumption and pollution levels serve to protect the air quality in the new towns and counties.

**Preservation of ethnic cultures**

Beichuan County is China's only autonomous county for the Qiang ethnic group. Reconstruction sought not only to protect Qiang ethnic culture but also to highlight the cultural uniqueness of the Qiang people. The five districts incorporate Qiang style in various ways (they feature traditional Qiang styles, modern Qiang styles, traditional Han-Qiang styles, or modern Han-Qiang styles). The buildings in the town are mainly small high-rises in neutral or warm colors like putty, yellow, and white. Building height is limited (guidelines require that mountains and rivers be visible), giving the horizon a smooth and layered appearance. Buildings are well-proportioned, with corridors in the lower levels, and with mountains forming the backdrop. By both retaining and reinterpreting the Qiang style, the uniqueness of Qiang culture as manifested in western Sichuan landforms was preserved. This approach also integrated traditional and modern ways of living.

**Emphasis on safety**

During reconstruction, seismic fortification criteria were raised and the Code for Seismic Design of Buildings strictly followed. The seismic fortification intensity for buildings in New Beichuan County is VII (7) degrees; for lifeline systems like transportation, water supply, power supply, communications, education, medical care and public health, grain supply, and fire fighting, the seismic fortification intensity is one degree high than the requirement in order to ensure that these systems function during earthquakes. In Hanwang Town, the seismic fortification intensity is VIII (8) for buildings and IX (9) for public service facilities and lifeline projects. Zhuyuan Town has adhered to the standard that buildings should stand after strong earthquakes, be reparable after moderate earthquakes, and be undamaged after minor earthquakes. It intends to construct a disaster-resistant town with a seismic fortification intensity of VIII (8) degrees.

All three areas have left reasonable space between buildings to satisfy the needs of emergency evacuation. New technologies such as steel-frame structures and rubber supports are widely used in buildings, which greatly improves buildings' earthquake-resistance capacity.

Emergency shelters have also been built according to plan. There are eight new permanent emergency shelters in New Beichuan County that cover an area of 0.64 $km^2$; the radius of service for each shelter is about 600 m. Using large spaces such as roads, squares, parks, and school playgrounds, Zhuyuan Town in Qingchuan County built permanent, temporary, and emergency shelters covering 252,000 $m^2$ with a service radius service of 200 – 800 m; the per capita shelter area is 2 $m^2$. Hanwang Town repaired and completed various emergency resource facilities to make Hanwang Park into a comprehensive earthquake prevention facility. Parks, squares, greenbelts, playgrounds, and stadiums are also designated as evacuation areas to be used before people can conveniently evacuate to nearby shelters. People can reach the temporary shelter within 5 to 10 minutes and the longer-term shelter within half an hour.

Prevention of natural disasters has also been stressed. The flood resistance specification for the Anchang River in Beichuan County has been raised to the once-in-50-years standard, while for other rivers in Beichuan, such as the Yongchang River, the Shenlong River, and the Jiangjia River, the specification has been raised to the once-in-10-years standard. Dikes along the Anchang River have been raised and reinforced, and flood discharge channels have been repaired or built for the Yongchang River, Shenlong River, Jiangjia River, and Guihua River. Hanwang Town raised the flood-resistance standard of dikes for the Mianyuan River to once-in-50-years and reinforced dikes and river channels to improve flood discharge capacity. In Zhuyuan Town, the flood resistance standard for Qingzhu River was raised to once-in-50-years, while the resistance standard for mountain torrents was once-in-20-years. In addition, drawing on the report of the Chengdu University of Technology (Appraisal Report on the Fatality of Geological Disasters in Zhuyuan Town in the Site Selection Plan of Qingchuan County), Zhuyuan Town planning takes account of zones considered prone to geological disasters.

## Industrial Development as the Economic Foundation for Sustainable Development

During off-site reconstruction, industrial development was a key consideration. The capacity for self-development and sustainable development of the earthquake-stricken areas was greatly improved in reconstruction, and a solid foundation established for long-term development. In constructing industrial parks, attracting competitive enterprises, and supporting traditional characteristic industries, the three areas have been remarkably successful in meeting the goals of improving industrial development levels, optimizing industrial structure, and developing characteristic industries.

**Importance of improving industrial development**

In New Beichuan County, Shandong Industrial Park (built with the assistance of Shandong Province) has been put into use. The industrial park covers an area of 1.4 $km^2$, and 25 enterprises have located at the park with a total investment of Y 1.6 billion; 22 of the enterprises are from Shandong, with total investment of Y 1.5 billion. These enterprises are suitable to the labor force in Beichuan and include agriculture sideline processing, textiles and apparel production, and new building materials production. Standard workshops have been built in the eastern part of the county, which have attracted tourism-related enterprises, including small and medium-size labor-intensive enterprises, tourism product processing enterprises, and cultural and creative enterprises.

Wuxi-Hanwang Industrial Park mainly focuses on machining operations, environmental equipment production, and instrument and apparatus production and logistics. It covers an area of 2 $km^2$, and its standard workshop (30,000 $m^2$) and its supporting facilities have been finished. Investment in the park thus far comes to about Y 170 million. The industrial park introduced the industries transferred from Jiangsu Province and has attracted other industries. Y 1 billion has been invested thus far in seven projects involving Yongda Corporation in Wuxi, Jiangsu Province, as well as Qiaolian Corporation, Tianqi Logistics, and Linsenmu Corporation in Sichuan Province; the total planned investment volume will be Y 2.43 billion. In addition, agreements have been reached on projects involving blade processing and wind-power conductor rails, with an investment of Y 200 million. The park and these enterprises lay a solid foundation for the recovery and development of industries in Hanwang Town.

In Zhuyuan Town, three concentrated industrial parks have been established, Huangsha Zheshang Industrial Park, Taba Biomedical Park, and Beiya New Material Industrial Park. Each park has a unique style and major industry. The three parks nurture leading industries like finish machining of minerals, biomedical enterprises, and forest products processing, and they have attracted 13 key enterprises, including Kechuang Corporation in Sichuan Province, Zhongzhe New Material, and Jinshi Silicon Corporation in Sichuan Province. It is estimated that by the end of the 12th five-year plan (in 2015), the total value of output in the three parks will reach Y 3 billion.

**Importance of optimizing industrial structure**

With the knowledge that Dongfang Turbine would leave the area, Hanwang Town took the opportunity of reconstruction to reform its industrial structure and to change its pillar industry from mechanical manufacture to tourism. Several tourism regions with different focuses – nature and the environment, earthquake relics, and vacation and leisure – have now been formed. They offer a range of tourism activities that take advantage of the area's natural environment and earthquake-related experiences and relics. These types of tourism have given rise to a variety of entrepreneurial opportunities, including rural home inns as well as agricultural tourism, travel, and sightseeing businesses.

**Importance of protecting unique industries**

To protect its unique industries, Beichuan has constructed an "ethnic" commercial street (called "Banaqia," the Qiang word for "business area") where handicrafts are sold in close proximity to the and workshops where they are produced. In Hanwang Town, where Mianzhu new-year paintings and Jiannanchun spirit culture are the intangible cultural heritage, these traditions are protected and the paintings and spirit cultural industries are supported.

## Protecting Traditional Culture in Successful Off-Site Reconstruction

The protection and promotion of traditional cultures was of great importance during reconstruction. Special attention was paid to the protection and preservation of traditional culture during the off-site reconstruction in Beichuan County, Qingchuan County, and Hanwang Town so that the new areas would combine modern features and unique ethnic characteristics. As described above, the building style in New Beichuan County reflects the Qiang ethnic culture and a combined Han-Qiang style, in keeping with the status of Beichuan County as the only autonomous county of the Qiang ethnic group. After the earthquake, Beichuan County issued the Conservation Regulation for the Intangible Cultural Heritage in Beichuan Qiang Autonomous County to ensure that the Qiang cultural heritage was preserved and protected. Hanwang Town focused on protecting religious culture, including the Mianzhu new-year paintings and the Jiannanchun spirit culture.

## Protecting the People's Interests in Successful Off-Site Reconstruction

As outlined in the Overall Plan for Post-Wenchuan Earthquake Recovery and Reconstruction, the main goals of reconstruction were to ensure that every family had a house, every household included a person with a job, every person was safe, public facilities were improved, the economy was boosted, and the environment was protected. All of these goals reflect the fundamental interests and livelihood of people. During the off-site reconstruction, the starting point and objective of all the work was to achieve these goals and protect people's fundamental interests.

The goals have been met as follows: First, through scientific site selection, increased seismic fortification standards, and the construction of disaster prevention and reduction systems, the life and property security of people has been guaranteed. Second, by giving priority to construction of housing and to public service facilities such as schools, medical and public health facilities, and cultural and sports venues, public service capacity has been greatly improved. Third, by focusing on promotion of industry and optimization of industrial structure, sustainable development capacity was enhanced in the earthquake-stricken areas. Fourth, training was conducted to promote employment and solve the job problem. Fifth, through expanded social security criteria, allowances to the poorest, and reduction in medical fees, the basic life problems of the disadvantaged have been addressed. Sixth, most construction work was performed by local residents, who participated in and played an indispensable role in construction. In planning, site selection, and construction, people's opinions were solicited, taken into consideration, and respected. People's satisfaction was the criterion for judging the work. This degree of involvement ensured that the process of reconstruction would serve the interests of the people.

# 5

# Problems Exposed and Policies Proposed

This chapter describes some of the problems that planning and implementation of off-site reconstruction gave rise to. It also makes recommendations for policies to guide postdisaster off-site reconstruction in the future.

## Problems

### Planning misjudgments

Compiling a reconstruction plan after the earthquake was a huge systematic project. At the beginning, the situation was especially complicated, and it was difficult to devise a plan that adequately addressed every aspect of it. The overall compensation needed for land requisition and removal, for example, was underestimated, resulting in a shortage of funds during the implementation of off-site reconstruction of Beichuan and Hanwang. This problem was solved through adjusting the plan and increasing the funds, but there is no doubt that the process of reconstruction was to some extent hampered by this underestimation. To avoid such errors, plans for future reconstruction should include a mechanism for readjusting the plan in response to real conditions of the disaster-stricken areas so that it can more effectively guide the reconstruction process.

### Secondary disasters

Although the importance of preventing and controlling secondary disasters is recognized, their destructive power seems to be underestimated. When a high magnitude earthquake strikes, it causes massive destruction – but that is not the end of the story; unpredictable geologic hazards and aftershocks are common in both the seismic center and the surrounding areas of the fault zone.

Some reconstruction projects were forced to carry out reconstruction twice because the first reconstruction took place in an unstable area. For example, in Qiaozhuang Town, some buildings reconstructed on a seismic fracture in a fault zone were severely damaged by aftershocks and had to be reconstructed again in another place. This fault zone is currently the site of urban roads and public lawns.

### Improper functional divisions

At the beginning of reconstruction, according to a public opinion poll in Qingchuan County, most residents were reluctant to leave the old county and did not support off-site reconstruction. Meanwhile, because of the mountainous terrain in Qingchuan County, it was difficult to find enough land on which to build a new county. After much research and further surveys, a plan for off-site reconstruction was drawn up that divided Qingchuan County into two functional parts: in Qiaozhuang Town, Communist Party and government offices were to be located, along with shopping outlets; Zhuyuan Town was to be the educational, cultural, and industrial center.

This model has certain flaws. Qingchuan's mountainous terrain already serves to weaken its centralization and radiation functions. The functional divisions determined on as part of reconstruction will not only further weaken its centralization function, they will increase social and economic administrative costs and people's living and production costs.

## Policy Recommendations

In addition to the problems cited above, several other problems arising out of off-site reconstruction have recently come to light. These include local governments' heavy loan burdens due to huge payments for off-site reconstruction land acquisition and removal; low industrial development levels; backward city and town administration; weak employment prospects; and difficulties helping and supporting the poor.

**Measures to relieve government debt**

Because of planning omissions, the problem of a Y 480 million funding shortage for land acquisition and removal in New Beichuan County, Zhuyuan Town in Qingchuan County, and Hanwang Town in Mianyang City remains unsettled. At present, local governments have settled part of the funding source via government financing, which burdened them with heavy debts. To make things worse, local governments' efforts to promote economic recovery in quake-stricken areas have led to financial expenditures that exceeded tax income; this situation also increased government debts that cannot be repaid in a short period of time.

This issue can be addressed as follows: first, the central government should provide more financial subsidies to the earthquake-stricken area. Second, local governments should be self-reliant and strive to remove debts by cutting general outlays, adjusting structural outlays, and collecting further income. Third, local governments should broaden channels for raising funds. To increase the multiplier effect of funds, methods such as financing assurance, discounts, and build-operate-transfer should be used. Finally, donor provinces and cities under the twin assistance mechanism should enhance their follow-up support of specific projects as well as their support for recipient counties' long-term development.

**Measures to encourage industrial development**

After reconstruction of the industrial parks, the earthquake-stricken area's industrial layout was optimized and adjusted; the environment was improved, there appeared to be no difficulty in attracting outside investments. In general, however, the industrial development level of earthquake-stricken area remains low.

The problems and difficulties are these: First, investment will steeply decrease after reconstruction is complete. According to the data from 2008 – 2010, investment is shrinking year by year. As short-term central and provincial support policies have come to a close, support to the earthquake-stricken area likely shrank further in 2011. Second, the conditions and environment for investment are currently insufficient. The big transportation system undertaken as a part of the reconstruction project was still under construction as of this writing. It will take several years to complete the system, form its allocation function, and consummate its function as a transportation joint terminal. Rome was not built in a day, nor will the reconstruction project be completed in one. The acceleration of industrialization in affected areas, and the opening up of these areas to the world, require improvements in the investment environment and policies as well as transfer of government functions and better services for companies. Third, when the reconstruction is complete, consumption of construction materials and equipment such as cement, steel, and engineering machines will decline, and overcapacity will lead to a decline in the number of jobs.

Opportunities come with challenges. The opportunities in postdisaster reconstruction are provided by industrial transmission both at home and abroad, the advancing and deepening development of western regions and the Chengdu-Chongqing Economic Zone, the input and investment under the twin assistance mechanism, and the project to economically develop the western highlands. Rejuvenation of industry will require the following steps:

First, promote investment growth as the driving force of economic growth. In addition, optimize investment structure by focusing on the quality of investment growth; investment channels should be broadened, and the scale of nongovernment investment gradually increased. Second, speed up industrial development. Sichuan Province is in the middle stage of industrialization, meaning that advancing industrial development will become the main driving force of economic growth and development for primary and tertiary industry. Construction of centralized, group, and intensified industrial layout should be conducted on the basis of the new industrial parks constructed after the disaster. According to the real condition of Beichuan, Qingchuan, and Hanwang, efforts should be made in receiving industries transferred from Shandong, Zhenjiang, and Jiangsu. An abundant labor force should be taken advantage of and a labor-intensive industry developed; abundant resources should also be taken advantage and traditional industries (such as agricultural byproduct processing, building materials and chemical manufacture, and machine manufacture) developed. Third, the government should value the private economy, which is an important force for postdisaster reconstruction. In the postreconstruction period, the government should promote development of the private economy by offering more financial support to solve the financing problems of small and medium-size companies. The government should also loosen investment restrictions by guiding the private economy into investment areas such as public services, social services, and financial service, as well as modern logistics. Moreover, the government should intensify assistance to the private economy through comprehensive use of government investment subsidy, loan discount, and tax preference.

**Measures to modernize administrations**

Great changes have taken place in Beichaun, Qingchuan, and Hanwang as a result of postdisaster reconstruction. New cities and towns are equipped with new facilities. But management and government administration in these places remain backward. To achieve modernization, these cities and towns need to improve land management, city appearance management, management of local attractions, traffic management, social stability management, community management, and disaster prevention and relief management.

Local governments should in the first place foster a correct concept of administration. That is, they should obey the rules of the market economy and give full play to the basic role of the market in allocating resources. In addition, local governments should accelerate the process of basing urban management in information and information technology, should construct city planning information systems and government public services information systems, and should extend application of digital technology and network technology to local government administration work. Finally, funds for city administration and training should be increased.

**Measures to increase employment, improve work relief, and promote sustainable development**

Among the 39 disaster-stricken counties in

Sichuan Province, 31 were beneficiaries of the aid-the-poor development project that offered assistance to 2,117 poverty-stricken villages. After the earthquake, 399 villages were added to the number of beneficiaries, including 253,100 poor families, or a total population of 837,500. A large number of people are in need for a variety of reasons. Some have taken out substantial loans to rebuild houses and are stretched thin financially. There are orphans, old people, and disabled individuals who also need aid, as well as households that lost supporting laborers, people who cannot afford school or medical treatment, and unemployed workers seeking jobs. In devastated areas like Beichuan, Qingchuan, and Hanwang, most residents lost all of their property in the earthquake, and many people now live in poverty. Moreover, industrial and mining establishments need time to recover production, which has limited jobs. Finally, moving to the new cities and towns increases people's living expenditures.

Local governments' task of increasing the employment rate and supporting the poor is clearly an arduous one, but a number of steps can be taken to help those in need. First, local governments should promote industrial development to create more jobs for local people, should enhance cooperation with coordinate supporting provinces, and should enlarge the scale of exporting labor services. Second, labor skills training should be enhanced and local people enabled to create job opportunities for themselves. Third, the policy system supporting employment should be perfected, and local governments should provide more policies offering tax relief, financial preference, and the like. Fourth, the capital input and development scope for poverty reduction should be increased. Fifth, the community-based relief system and social security system should be perfected while fully guaranteeing the basic needs of the low-income population.

# PART SEVEN

## Evaluation of Wenchuan Earthquake Postdisaster Reconstruction and Organizational Implementation System

# Introduction

The Wenchuan Earthquake caused immense loss of lives and property and also harmed economic and social development in the affected areas. The Chinese Communist Party Central Committee and the State Council promptly organized the postdisaster restoration and reconstruction in a way that drew on national strengths, put people's needs first, and was based in science.

Postdisaster restoration and reconstruction is a large, systematic, and complex project that requires coordination among the national various departments, and that should draw on other countries' experiences. This report compares the Chinese experience of reconstruction following the Wenchuan Earthquake and other countries' experiences with reconstruction after natural disasters. It analyzes theories of postdisaster reconstruction, describes postdisaster reconstruction policy and the organizational implementation system in China, considers instances of postdisaster reconstruction in major countries of the world, and makes recommendations about future postdisaster reconstruction in China. Unless otherwise specified, data cited are from the World Bank working paper by Wolfgang Fengler, Ahya Ihsan, and Kai Kaiser cited in note 6 below, and from the Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction, the Wenchuan Earthquake Recovery Counterpart Support Scheme, and other government planning documents.

# 1

# Overview of Reconstruction Theories at Home and Abroad

Given the frequency of natural disasters, postdisaster reconstruction has gradually become an important issue in management for governments around the world. Academics and international organizations have intensified research on postdisaster reconstruction; they have improved the practice of disaster management and advanced theoretical approaches. Domestic research in this field has also gradually been incorporated into the views of theorists. Especially since the outbreak of SARS in 2003, theoretical issues involved in disaster management and postdisaster reconstruction have received increasing attention, and the scope and depth of the research being carried out have in turn been enhanced.

## Theory of Disaster Prevention and Disaster Reduction

Disaster prevention and disaster reduction form a complex system that is related to all aspects of how people live and work as well as to questions of funding. According to Wisner, Blaikie, Cannon, and Davis, disaster prevention and reduction has seven steps:

(1) accurately assess disaster situations, environmental vulnerability, management capabilities, and other conditions;

(2) accurately assess potential risks through analysis of risk, environmental vulnerability, and management capabilities;

(3) lessen the risk by eliminating underlying causes, dynamic pressures, and unsafe conditions;

(4) incorporate the risk reduction work into sustainable development;

(5) reduce risks by improving living conditions;

(6) incorporate the risk reduction work into postdisaster restoration and reconstruction; and

(7) strive to create a culture of safety[1]

Because the management work of disaster prevention and reduction is complex, any model for it should be comprehensive. Shi Peijun has proposed that, within the overall framework of disaster mitigation, a three-dimensional matrix model consisting of horizontal, vertical, and political harmony should be established for the reduction of disaster risks.[2] Disaster prevention and reduction work should give full play to market mechanisms, mobilize all stakeholders to participate, and avoid unduly burdening government.

Empirical analysis has suggested that relatively

1 Ben Wisner, Piers Blaikie, Terry Cannon, and Ian Davis, At Risk: Natural Hazards, *People's Vulnerability and Disasters* (London: Routledge, 1994).

2 Shi Peijun, "Theory and Practice of Disaster System Research in a Fourth Time," *Journal of Natural Disasters* 14, no. 6 (2005): 1–7.

small investments in disaster prevention produce significant economic benefits. According to economist Luo Yun, remediation after an event costs about fives times as much as preventive measures before the event, so that a predisaster input of Y 1 equals a postdisaster input of Y 5.[3] By this formula, disaster prevention and reduction is cost-effective.

There are five components to an effective disaster prevention system. The first is an emergency command system. Sun Shide and others argue that the command system for disaster prevention and relief should be an entity, a permanent body, rather than something merely virtual or conceptutal.[4] Under this view, the central government sets up a unified disaster prevention and relief headquarters, while local governments set up appropriate functional departments for disaster relief, including departments concerned with food, energy, electricity, water conservancy, transportation, communication, weather, and other matters related to the national economy and people's livelihood. The second is a disaster warning and forecasting system to predict the time, place, manner, scope, and scale of possible disasters and issue disaster warning reports. The third component is a materials-reserve system to collect and store materials for use in emergencies, such as medicine, food, tents, and so on. The fourth component is a publicity and education system to teach the public important information and skills (for example, the importance of responding to early warnings and self-help in a disaster) in order to increase people's resilience and reduce loss of life and property. The fifth component is a market-based disaster prevention and relief insurance system offering mutual benefits and mutual protection.

## Methods and Measures of Postdisaster Reconstruction

### Objectives of postdisaster reconstruction

Hu Angang lists seven objectives of postdisaster reconstruction that can be quantitatively assessed: housing, employment, income growth, public service levels, economic growth, infrastructure restoration, and ecological restoration.[5]

Damaged housing should be repaired and reinforced; new building should take place through self-build, community-build, and similar methods. Employment opportunities should be increased through local job creation, off-site job arrangements, and other channels in order to raise the employment rate above the predisaster level. Income growth should be promoted in order to raise the per capita disposable income of urban residents and per capita net income of rural residents above predisaster levels. Basic public service levels should be improved so that education, health care, culture, sports, and other public services are better than, and reach more people than, before the disaster. The economy should be revitalized so that rates for economic growth and GDP growth surpass predisaster rates and so that productivity layout and industrial structure are optimized. Finally, infrastructure and the ecological environment should be restored.

### Stages of postdisaster reconstruction

After the disaster, the government must immediately mobilize a large number of public resources to carry out restoration and

3 Luo Yun, "Safety is the Productive Force," CCTV. com, http://www.cctv.com/news/china/20040325/101254.shtml.

4 Sun Shide, Xiong Fei, and Qiu Feng, "Some Ideas about the Construction of an Emergency Disaster Prevention Mechanism," *Civil Defence Realm* (2008 [supplement]): 21–22.

5 Hu Angang, "The Main Goal of the Post-disaster Reconstruction and Basic Ideas," *Journal of Literature, History and Philosophy* 6 (2008): 28–31.

reconstruction, that is, to restore the affected areas to a normal state and to achieve sustained economic and social development. Postdisaster restoration and reconstruction can be divided into three stages. The first stage focuses on government-led disaster restoration. This stage usually lasts several weeks, and then transitions into reconstruction planning. The second stage encompasses emerging restoration and establishment of a plan for full postdisaster reconstruction, which is the key to success for the whole postdisaster restoration and reconstruction project. The third stage is the implementation of the postdisaster reconstruction plan. Overall, the postdisaster restoration and reconstruction process follows a "restoration-reconstruction-development" pathway.

**Formation of postdisaster reconstruction institution**

The postdisaster reconstruction work should be carried out by a specific institution. A reconstruction institution can be formed in one of two ways: either as a new institution that coordiates other institutions within the existing government framework, or as a new institution with specific authorities and responsibilities. Both modes have their advantages and have been generally used. According to analysis by the World Bank, the choice of mode generally depends on three factors: the scale of disaster and reconstruction plan, disaster location, and the existing capacity of local government.[6] In general, if the disaster and reconstruction plan are large, the disaster is in a remote location, or the local government has more resource capacities, it is easier to establish a powerful coordinating and implementing institution. However, if the local government is relatively strong, and the implementation of the reconstruction plan will challenge the existing management structure, existing management institutions should be used regardless of the scale of losses and reconstruction planning.

The World Bank analysis suggests that disaster restoration and reconstruction authorities have three main functions: coordination, which is the core function of the postdisaster restoration and reconstruction institution; supervision, which ensures adequate funding for urgent needs, efficient use of resources, and delivery of resources to targeted groups; and implementation, which is a nonessential function in cases when reconstruction plans are large and complex and the government is unable to implement them.[7]

**Content and modes of postdisaster restoration and reconstruction**

In accordance with the prevailing theory, postdisaster restoration and reconstruction includes but is not limited to the following: repair/restoration of the environment; reconstruction of local infrastructure; restoration of employment and livelihood, major infrastructure, and living facilities; environmental and water resource management; and housing. Some new ideas for modes of postdisaster restoration and reconstruction have recently been put forward. For example, Feng Qianbin suggests that public-private partnerships can be a mode of funding infrastructure reconstruction.[8]

**Measures for postdisaster restoration and reconstruction**

As a large, complex, systematic project, postdisaster restoration and reconstruction needs to rest on a series of comprehensive policy measures in order to ensure that the affected areas can resume production as soon as

6 Wolfgang Fengler, Ahya Ihsan, and Kai Kaiser, *Managing Post-Disaster Reconstruction Finances – International Experience in Public Financial Management*, Policy Research Working Paper 4475, World Bank, 2008.

7 Ibid.

8 Feng Qiaobin, "Fund Raising and Management for Wenchuan Earthquake Reconstruction," *Subnational Fiscal Research* 9 (2008): 25 – 27.

possible and achieve sustainable development.

## Assessment Methods for Disaster Losses

Loss assessment is a precondition for carrying out postdisaster restoration and reconstruction. Only reasonable and accurate estimation of the losses caused by natural disasters can provide strong support for the government's preparation of disaster reconstruction plans and provide the basis for resource scheduling.

### Specific content of disaster losses

The impact of disasters is very large, encompassing not only human, financial, material, and other physical losses, but also social, emotional, and other intangible losses. Some losses, such as cultural or historic artifacts or other intangible assets, cannot be measured in monetary terms. On the whole, the assessment of disaster losses can be understood in either a broad or a narrow sense. Disaster losses in a broad sense include all the negative impacts to the entire economy and society stemming from the natural disaster – that is, both tangible and intangible losses. Disaster losses in a narrow sense include only human, financial, and material losses – that is, the casualties and economic losses caused by disasters; economic losses are understood both as direct economic losses of buildings, public infrastructure, property and so on, and as indirect economic losses due to temporary halting or reduction of production, or to disturbance of a balanced economic system and the reduction of foreign investment, as well as the direct input for disaster relief. It can be very difficult, and indeed is sometimes unnecessary, to measure disaster losses in a broad sense, so academics generally use the narrow concept.

Direct economic losses can generally be measured in monetary terms and fairly intuitively, so they can be assessed relatively simply. According to Zhong Jiangrong and Lin Junqi, the indirect economic losses can be measured as shown in figure1.1.[9]

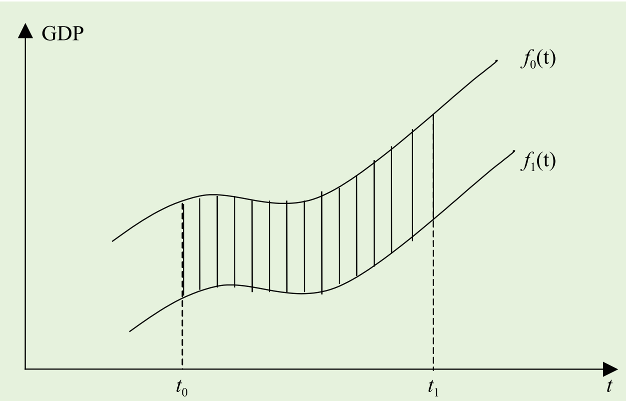


**Figure 1.1 Measurement of Indirect Economic Losses**

*Source*: Zhong Jiangrong and Lin Junqi, "Indirect Economic Loss Evaluation on Regional Earthquake," *Journal of Natural Disasters* 16, no. 4 (2007): 141.

In the figure, $f_1(t)$ refers to a function of GDP over time after the disaster, and $f_0(t)$ refers to a function of GDP over time in a normal state, so that the indirect economic

9 Zhong Jiangrong and Lin Junqi, "Indirect Economic Loss Evaluation for Regional Earthquake," *Journal of Natural Disasters* 16, no. 4 (2007): 139–42.

losses – the striped part of the figure – can be expressed as.

$$L = \int_{t_0}^{t_1} [f_0(t) - f_1(t)]\,dt,$$

If the two curves are parallel, the integral value is infinite, that is, the impact of the earthquake will persist. In practice, the curve after a disaster will gradually catch up with the prediction curve before the earthquake, and experience shows that the indirect losses that occur within one or two years after a disaster often account for most of the total indirect losses.

**Assessment procedures for disaster losses**

The disaster loss assessment is often led by the local government, which properly directs the higher levels of government, nongovernmental organizations (NGOs), community organizations, and other institutions that participate. The assessment is conducted in accordance with specfic procedures and steps. The State Seismologic Bureau's assessment of earthquake losses, for example, divides procedures into the following fourteen steps: (1) seek preliminary understanding of the disaster situation, determine the scope of the disaster areas, and divide them into subregions for assessment; (2) determine the structural types of housing; (3) devise uniform classification criteria for various structural damages levels; (3) select sampling points; (4) survey housing structural damages; (5) calculate the break ratio according to sampling survey results; (6) determine the loss ratio of various structures; (7) investigate the construction area for various types of structures and housing; (8) calculate the direct economic loss of housing; (9) calculate the direct economic loss of power, transportation, communications, drainage, gas supply, and other lifeline systems; (10) assess the property losses; (11) summarize other direct economic losses; (12) investigate the direct input for disaster relief; (13) estimate indirect economic losses; (14) select the correction factors, summarize loss assessment results, and prepare the report.

**Assessment index system for disaster losses**

Because there are multiple variables in each case – different potential hazards, elements at risk, and environments – the range, degree, and content of losses will differ significantly for different disasters. Thus there is no uniform assessment index system for disaster losses, and different scholars use different measurement systems in conducting loss assessment. For example, Ren Luchuan divides disaster losses into social and ecological-environmental.[10] Social losses include the number of deaths, number of injuries, direct economic losses, indirect economic losses, disaster relief losses, and others. Ecological-environmental losses include losses of land resources, freshwater resources, mineral resources, atmospheric resources, and others. Wei Qingchao divides the disaster loss index into an attribute index and a monetary index.[11] The attribute index includes casualties and disaster losses, while the monetary index includes property losses, disaster relief costs, and efficiency losses.

## Finance and Financing Mechanism for Postdisaster Reconstruction

**Fiscal policy: Taxes**

Tax policy is an effective means to help the disaster area to restore production and rebuild homes, and it is commonly used in disaster restoration and reconstruction around the world. Gan Shengdao has pointed out that while government funding and community

10 Ren Luchuan, "Fuzzy Synthetic Method Applied in Assessment of Storm Tide Disaster Losses," *Journal of Catastrophology* 11, no. 4 (1996): 6 – 10.

11 Wei Qingchao, "Space Characteristics and Calculation of Disaster Economical Losses," *Journal of Catastrophology* 10, no. 4 (1995): 28 – 32.

donations play a role in postdisaster restoration and reconstruction, they are not long-term stable resources, and governments must therefore use fiscal policy to transfer and attract capital.[12] One such policy is to offer tax incentives to businesses and individuals in the disaster area, including the reduction and remission of corporate and personal income tax and sales tax as well as a refund for value-added tax (VAT) for affected companies. Another is to offer tax incentives to businesses and individuals that assist with postdisaster reconstruction but do so outside the disaster areas, such as allowing charitable contributions to be full deducted from taxable income of the public welfare donations or returning a certain percentage of the VAT.

**Fiscal policy: Expenditures**

*Source of funding*

In Feng Qiaobin's analysis of post-Wenchuan Earthquake reconstruction, disaster restoration and reconstruction funds include the following: postdisaster restoration and reconstruction funds from the central government, reconstruction funds offered under the counterpart support ("twin assistance") mechanism, various domestic and foreign donations, the financial funds from the disaster area governments, bank credit funds, government bonds, and lottery revenues; power, telecommunications, water, electricity, and large state-owned enterprises also devote some of their existing funds to restoration and reconstruction of relevant facilities to bridge any gap in reconstruction funding.[13]

*Prepartion of reconstruction budget*

Wolfgang Fengler, Ahya Ihsan and Kai Kaiser suggest that the preparation of a postdisaster reconstruction budget be based on assessments of postdisaster losses and resources needs.[14] It must take into account the scale of external assistance from donors and determine the reconstruction strategy and implementing institutions, and then, according to the budget management provisions, form the closed-loop budgeting and management system of plan, budget, implementation, accounting report, audit, supervision, and assessment. The process is shown in figure 1.2.

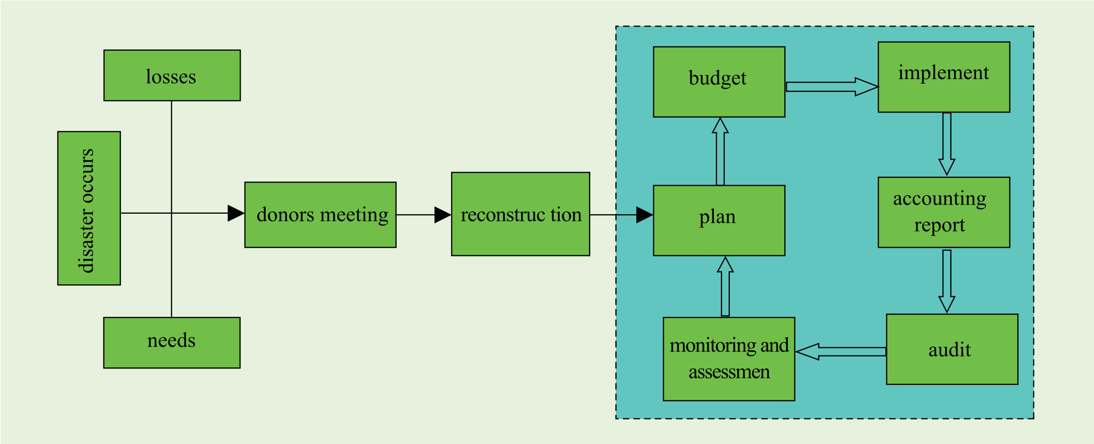


**Figure 1.2 Process of Preparing a Postdisaster Reconstruction Budget**

Source: Wolfgang Fengler, Ahya Ihsan, and Kai Kaiser, Managing Post – Disaster Reconstruction Finances – International Experience in Public Financial Management, Policy Research Working Paper 4475, World Bank, 2008.

12 Gan Shengdao, "Suggestions on the Implementation of Tax Preference Policy for Postdisaster Reconstruction," *Sichuan United Front* (2009): 16 – 17.

13 Feng Qiaobin, "Fund Raising and Management."

14 Fengler, Ihsan, and Kaiser, "Managing Post-Disaster Reconstruction Finances."

*Differences between disaster reconstruction budget and regular budget*

The disaster reconstruction budget is different from the regular budget in several distinct ways. First, the postdisaster reconstruction budget is highly time sensitive, so the financial department needs to act promptly and pay the appropriated funds in a timely manner. Second, the postdisaster restoration and reconstruction budget needs a high degree of flexibility so that fund users can quickly make adjustments according to changes in actual conditions. Third, postdisaster reconstruction is wide ranging and has many participants, so all aspects need to be fully considered in developing the budget, and convergence of the government budget funds, donations, and other income needs to take place.

*Importance of funds coordination in reconstruction budget management*

Feng Qianbin maintains that though the Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction specified the allocation of various funds in principle, the intercrossing of funds was possible and could occur in a variety of situations, such as when reconstruction funds had a complex source that was beyond the scope of the government's administrative coordination, or when the government of the disaster area lacked experience coordinating NGOs involved in the reconstruction.[15] He recommends improving funds' efficiency by seeking to reduce overlapping content, for example, by defining the major investment of financial funds at various levels and by strengthening communication with donors.

**Financing mechanism**

The financing mechanism is an important means of supporting the healthy development of the disaster area. Special credit, differential credit, and other means may be used to activate investment and to guarantee sufficient reconstruction funds. For example, a moderately sloping credit policy could be implemented, or the intensity of credit availability in the disaster area increased, or a preferential interest rate policy for engineering machinery, cement, building materials, transport, and consumption could be implemented. Other mechanisms could be used to enhance the loan loss identification and write-off of financial institutions in the disaster areas, to open up preferential financing channels, and to guide financial institutions to further expand the coverage of microcredit for farm households in the disaster area (that is, increase the microcredit loans and extend the term of the loans).

The financing mode should be adjusted in conjunction with the progress of restoration and reconstruction work, so that the roles of government and the market in different stages may operate freely, and it should be implemented with different emphases in various stages. Zhengjie proposed three financing modes: for the initial stage of postdisaster reconstruction (years 1 – 3), a financial-led financing mode; for the development stage of postdisaster reconstruction (years 3 – 7), a financial-led mixed financing mode; and for the improvement stage of postdisaster reconstruction (after year 7), a diversified financing mode under the market economy system.[16]

## Monitoring and Assessment of Postdisaster Reconstruction

**Importance of monitoring and assessment**

Bob Alexander, Catherine Chan-Halbrendt,

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15 Feng Qianbin, "Discussion of the Capital Coordination and Configuration of Wenchuan Earthquake Reconstruction, *Financial Research Briefing* 28 (2008).

16 Zheng Jie, "Research on Reconstruction Financing Mode Applied after Wenchuan Earthquake," *Special Zone Economy* 7 (2010): 292 – 93.

and Wilmar Salim maintain that monitoring and assessment are important because they help to ensure progress, targeted rights, and environmental and economic goals.[17] Wolfgang Fengler, Ahya Ihsan, and Kai Kaiser see monitoring as the key to ensuring that there are sufficient funds for postdisaster reconstruction, that resources are used efficiently, and that urgent social needs are met.[18]

### Content of monitoring and assessment

According to Fengler, Ihsan, and Kaiser, the main content of the monitoring and assessment is timely and comprehensive forecast outputs, including allocation and use of funds (national and international, public and private), the process of reconstruction, and economic and social impact, and so on.

Consider the management of public funds, for example. Fengler, Ihsan, and Kaiser hold that a good management system for public funds should monitor whether the public resources are being transformed into output. Meanwhile, from the practice of postdisaster restoration and reconstruction in various countries, a set of criteria for the management and operation of postdisaster public funds can be inferred. Details are shown in table 1.1.

**Table 1.1 Selected Management Standards for Postdisaster Reconstruction Public Funds**

| Items | Objectives | Measurements | Experience and problems |
|---|---|---|---|
| Information | 1. Timely and comprehensive information on expenditures and payment of reconstruction resources<br>2. Comprehensive financial information<br>3. Material progress | 1. Six types of funds (from government, donors, and nongovernmental organizations)<br>2. Project progress<br>3. Economic and social impact | Fragmentary information; tendency of institutions to highlight their own information (partly for purpose of self-promotion) |
| Implementation: Effectiveness and efficiency | Timely implementation of reconstruction in accordance with the priority sequences:<br>1. Allocatation of resources and making of plans<br>2. Carrying out of work: government procurement and contract signing<br>3. Payment | 1. Implementation speed<br>2. Payment mode<br>3. Change from emergency situation to recovery situation. | Contradictory pressures of quick action and careful planning in the postdisaster reconstruction period, especially in the establishment of reconstruction institutions; early reconstruction is slow to ensure more effective reconstruction plan in medium term |
| Implementation: Fairness | Fairness of the implementation of postdisaster reconstruction plan | 1. Sectoral allocation and difference<br>2. Comparison of urban and rural allocation | Connection of reconstruction to funding means that rural or poor areas may get less attention than others in process of reconstruction |

17 Bob Alexander, Catherine Chan-Halbrendt, and Wilmar Salim, "Sustainable Livelihood Considerations for Disaster Risk Management: Implications for Implementation of the Government of Indonesia Tsunami Recovery Plan," *Disaster Prevention and Management* 15, no. 1 (2006): 31 – 50, doi: 10.1108/09653560610654220.

18 Fengler, Ihsan, and Kaiser, "Managing Post-Disaster Reconstruction Finances." References to Fengler, Ihsan, and Kaiser in the next subsection are to this document.

Con.

| Items | Objectives | Measurements | Experience and problems |
|---|---|---|---|
| Prevention of corruption | Efficient management to minimize fiduciary risks and corruption | 1. Presence of effective anticorruption measures<br>2. Presence of significant differences in capital flow;<br>3. Presence of mechanisms to balance reconstruction speed and fiduciary risk management | Reluctance of some government officials to serve as project manager for reconstruction planning because of strict anticorruption program |

Source: Adapted from Wolfgang Fengler, Ahya Ihsan, and Kai Kaiser, *Managing Post-Disaster Reconstruction Finances-International Experience in Public Financial Management,* Policy Research Working Paper 4475, World Bank, 2008.

**Methods of monitoring and assessment**

Depending on the different political systems involved in reconstruction and the relevant departments' responsibilities, the practice of monitoring and assessment for postdisaster restoration and reconstruction varies. The two basic methods for monitoring are internal monitoring of government departments and social supervision.

# 2

# Analysis of Chinese Postdisaster Reconstruction Policy and Organizational Implementation System

## Postdisaster Reconstruction Policy

After the Wenchuan Earthquake, and especially as the reconstruction work was carried out, the State Council and relevant ministries, local governments, and related bureaus issued a series of policies to support postdisaster restoration and reconstruction. These policies were prepared on the basis of disaster and loss assessments with the aim of articulating the socioeconomic objectives of postdisaster reconstruction; establishing the institutional framework for reconstruction; specifying the roles and tasks of the central government, local government, community, and engineering service providers (including planners, NGOs, and other intermediary organizations); and ensuring the orderly conduct of reconstruction work. The content covers comprehensive policy, fiscal policy, monetary policy, land policy, housing policy, industrial policy, counterpart support policy, employment policy, and other policies.

### Postdisaster reconstruction planning

*Implementation scope and time requirements of the overall plan*

The scope of the overall plan covered the 51 counties, cities, and districts of severly affected areas in Sichuan, Gansu, and Shaanxi Provinces (see table 2.1), with a total area of 132,596 $km^2$ and including 1,271 towns and 14,565 administrative villages. The plan allowed three years for completion of the main tasks of reconstruction. The goal was that at the end, the basic living conditions and economic development levels would reach or exceed predisaster levels, and that every family would have housing, every household would have employment, everyone would be safe, public facilities would be improved, the natural environment would be improved, and the economy would be developed.

*Basic principles of overall plan*

In devising the plan, the State Council adhered to the following principles: (1) people and livelihoods are primary; (2) nature is to be respected, and the plan is to based in science; (3) development should be integrated and coordinated; (4) innovative mechanisms should be used and collaboration fostered; (5) safety is a priority and quality must be assured; (6) it is important to practice economy and protect arable land; (7) it is important to protect cultural heritage and the natural environment; and (8) implementation should adapt to local conditions and proceed step by step.

*Main content of the overall plan*

The main content of the overall plan had 10

Table 2.1 **Planning Scope of Postdisaster Reconstruction**

| Provinces | Counties, cities, districts | Number |
|---|---|---|
| Sichuan | Wenchuan County, Beichuan County, Mianzhu City, Shifang City, Qingchuan County, Mao County, An County, Dujiangyan City, Pingwu County, Pengzhou City, Li County, Jiangyou City, Lizhou District of Guangyuan City, Chaotian District of Guangyuan City, Wangcang County, Zitong County, Youxian District of Mianyang City, Jingyang District of Deyang City, Xiaojin County, Fucheng District of Mianyang City, Luojiang County, Heishui County, Chongzhou City, Jiange County, Santai County, Langzhong City, Yanting County, Songpan County, Cangxi County, Lushan County, Zhongjiang County, Yuanba District of Guangyuan City, Dayi County, Baoxing County, Nanjiang County, Guanghan City, Hanyuan County, Shimian County, Jiuzhaigou County | 39 |
| Gansu | Wen County, Wudu District of Longnan City, Kang County, Cheng County, Hui County, Xihe County, Liangdang County, Zhouqu County | 8 |
| Shaanxi | Ningqiang County, Lueyang County, Mian County, Chencang District of Baoji City | 4 |
| Total | | 51 |

Source: Overall Plan for the Post-Wenchuan Earthquake Recovery and Reconstruction (State Council, September 2008, http://www.gov.cn/zwgk/2008-09/23/content_1103686.htm).

components.

First, the spatial distribution of restoration and reconstruction was to be organized scientifically, according to resources and environmental carrying capacity, with spatial planning area divided into three types: suitable reconstruction, moderate reconstruction, and ecological reconstruction. For each type, the basic principles of urban and rural layout, industrial layout, and population resettlement were to be identified.

Second, the requirements and related policies of residential housing reconstruction were to be identified according to the different characteristics of urban and rural housing construction and consumption.

Third, the urban layout was to be optimized, disaster prevention capabilities enhanced, and the living environment improved in accordance with the requirements of restoration and consummation functions and the overall arrangement.

Fourth, comprehesive urban and rural reform was to be combined with new rural construction and poverty alleviation and development. Rural production and living facilities were to be restored and reconstructed, and production bases built for high-quality grain and oil, special economic products, and other products.

Fifth, according to the urban and rural layout and size of the population, facilities for educational and scientific research, health care, culture and sports, natural heritage, employment and social security, and other public services were to be promoted.

Sixth, construction standards for transportation, communications, energy, and water conservancy facilities were to be determined and the facilities restored. Security capabilities were to be enhaced according to geological and geographical conditions as well as urban and rural economic and social development needs.

Seventh, guidance was to be offered to affected enterprises being reconstructed on site or off site, and the development of industries with local advantages supported.

Eighth, the disaster prevention and reduction system and comprehensive disaster reduction capacity was to be strengthened and disaster prevention and emergency rescue capabilities improved.

Ninth, nature, rules, and science were to be respected; ecological repair and environmental governance were to be strengthened, and development of the population, resources, and the natural environmental were to be promoted.

Finally, traditional Chinese culture, which emphasizes carrying on after a disaster, was to be preserved, and intangible cultural heritage with historical value and ethnic characteristics was be rescued and protected.

The overall plan also identified policy requirements for finance, tax, banking, land, industry, counterpart support, social assistance, and other areas, and made specific provisions for supervision of funds, projects, and important materials.

In addition, the National Development and Reform Commission and several ministries jointly issued 10 special plans for Wenchuan Earthquake restoration and reconstruction. These involved land use, the market service system, ecological restoration, rural development, the urban system, public service facilities, urban and rural housing, and other areas of conern.

**Fiscal policy for postdisaster reconstruction**

*Postearthquake restoration and reconstruction funds from central government*

To support the restoration and reconstruction of affected areas and coordinate and guide all types of funds, the central government established postearthquake restoration and reconstruction funds in the amount of Y 300 billion for a three-year period. The required funds came mainly from the following: budget revenue of the central government's state-owned capital, special revenue from the vehicle-purchase tax, central lottery funds, and the newly added construction land use fees paid to the central government.

The central government's postearthquake restoration and reconstruction funds were to be used for residents' personal subsidy, project investment subsidy, corporate capital injection, discount loans, and other expenses in order to support restoration and reconstruction of urban and rural housing, public service facilities, infrastructure, and industrial and agricultural production.

*Tax incentives*

The Ministry of Finance, State Administration of Taxation, and other agencies issued a series of policies on earthquake relief and reconstruction tax incentives designed to help enterprises resume production as soon as possible, reduce the personal tax burden, promote employment, support the restoration and reconstruction of infrastructure and buildings in affected areas, and encourage society's support for earthquake relief and postdisaster restoration and reconstruction. The tax incentives involved a range of taxes, including corporate income tax, personal income tax, corporate VAT, property tax, import and export tax, deed tax, resources tax, urban land use tax, travel tax, and stamp tax.

*Reduction or remission of governmental funds and administrative fees*

The plan called for reduction or remission of part of the governmental funds and administrative fees in severely affected areas for three years. For example, the use fees for newly added construction land and land transfer income were to be remitted, as were the Three Gorges Project construction funds and supportive funds for large and medium-size reservoirs resettlement; Sichuan, Gansu, and Shaanxi Provinces were to appropriately reduce or remit administrative fees of local revenues approved at the central level according to local conditions in severely affected areas, as well provincial administrative fees and some others.

*Policies supporting employment and social security*

To speed up the pace of postdisaster reconstruction, the financial sector developed a series of policies supporting employment and social security. According to the policy provisions, enterprises in the affected areas that absorbed workers who experienced difficulty in finding employment were to be given corresponding social insurance subsidies; moreover, self-employed personnel in the affected areas were to be free of certain administrative charges such as management fees, registration fees, and license fees for three years.

*Stronger transfer payment arrangements*

The central government strengthened financial support for the disaster areas, accelerated the issuing of funds for transfer payments through a "green channel,"[1]

and increased the size of the first distribution of transfer payments. In addition, it gave more direct indication to nonaffected areas to increase revenues and cut expenditures, and it established a counterpart support ("twin assistance") system, described in more detail below. Under this system, guided by the principle of "a province helps a severely affected county," provinces in eastern and central China were paired with and provided aid to a severely affected county in Sichuan, Shaanxi, or Gansu.

*Other supportive policies*

Other supportive policies included cutting public expenditures, both by postponing party and government office building projects and by imposing an across-the-board 5 percent cut in public expenditures; adjusting the income and expenditure structure in the budget; and strengthening financial management. This list involved managing internal and external funds in the budget, disbursing reconstruction funds promptly, focusing on process monitoring and subsequent supervision, and balancing uses of reconstruction funds in different regions and projects.

**Counterpart support in postdisaster reconstruction**

On June 11, 2008, the State Council issued a counterpart support ("twin assistance") plan for Wenchuan Earthquake restoration and reconstruction. It identified 19 provinces and cities to support 24 counties, cities, and districts of the severely affected areas in Sichuan, Gansu, and Shaanxi. Support was to last for a three-year period, and the supportive physical workload offered every year was not to be less than 1 percent of local government income in the prior year.

*Content and methods of counterpart support*

Counterpart support called for a combination of "hard" and "soft" support and a combination of "blood transfusion" – that is, outside assistance from the government and others – and "blood creation" – that is, self-development of affected areas. It was intended to mobilize human, material, financial, intellectual, and other forces and to give priority to improving the basic living conditions of people in disaster areas. Under counterpart support, donor provinces were to do the following: (1) provide planning, architectural design, expert consultation,

1 Also called a "goods to declare" or "exempt from examinations" channel, a green channel ensures that a process is speeded up.

project construction, and supervision services; (2) construct and repair urban and rural housing; (3) construct and repair schools and hospitals, as well as radio and television, culture and sports, social welfare, and other public service facilities; (4) construct and repair rural roads, water supply (drainage), gas supply, sewage and garbage disposal, and other infrastructure; and (5) construct and repair agriculture, rural infrastructure, and other rural facilities.

*Arrangement plan for counterpart support*

The 19 donor provinces were identified based on their economic strengths and on the situation of the recipient provinces. The pairings are given in table 2.2.

**Table 2.2 Counterpart Support Pairings for Wenchuan Earthquake Reconstruction**

| No. | Counterpart support pairings |
|---|---|
| 1 | Shandong Province: Beichuan County, Sichuan Province |
| 2 | Guangdong Province: Wenchuan County, Sichuan Province |
| 3 | Zhejiang Province: Qingchuan County, Sichuan Province |
| 4 | Jiangsu Province: Mianzhu County, Sichuan Province |
| 5 | Beijing Province: Shifang County, Sichuan Province |
| 6 | Shanghai: Jiangyan City, Sichuan Province |
| 7 | Hebei Province: Pingwu County, Sichuan Province |
| 8 | Liaoning Province: An County, Sichuan Province |
| 9 | Henan Province: Jiangyou City, Sichuan Province |
| 10 | Fujian Province: Pengzhou City, Sichuan Province |
| 11 | Shanxi Province: Mao County, Sichuan Province |
| 12 | Hunan Province: Li County, Sichuan Province |
| 13 | Jilin Province: Heishui County, Sichuan Province |
| 14 | Anhui Province: Songpan County, Sichuan Province |
| 15 | Jiangxi Province: Xiaojin County, Sichuan Province |
| 16 | Hubei Province: Hanyuan County, Sichuan Province |
| 17 | Chongqing Province: Chongzhou City, Sichuan Province |
| 18 | Heilongjiang Province: Jiange County, Sichuan Province |
| 19 | Guangdong Province (mainly Shenzhen): Severely affected areas in Gansu Province |
| 20 | Tianjin: Severely affected areas in Shaanxi Province |

Source: Wenchuan Earthquake Recovery Counterpart Support Scheme (State Council, June 2008, http://baike.baidu.com/view/1674156.htm).

*Implementation of counterpart support*

Since the beginning of the reconstruction, the provinces and cities have adhered to the principles of planning in advance, putting people's livelihood first, and carrying out a science-based reconstruction that addresses the actual situation of the disaster areas. The 19 donor provinces and cities invested a total of Y 82.5 billion in three years and made truly significant contributions to the reconstruction process.

One contribution was to accelerate the construction work. The donor provinces and cities worked in close coordination with the recipient counties and cities to implement the programs carried out under counterpart support and to strengthen the availability of financial, material, and construction aid. As of January 31, 2010, 28,186 items in 10 categories included for Sichuan Province in the national overall plan, in 10 special plans, and in a provincial annual plan had been started, accounting for 94.89 percent of the reconstruction tasks after adjustment. There were 21,944 projects completed, accounting for 73.88 percent of the reconstruction tasks after adjustment.

A second contribution was in the large number of livelihood projects completed. In determining which projects to aid, the donor provinces and cities adhered to the principle of giving priority to people's livelihoods, to public service facilities projects, and to infrastructure projects; they helped to speed up restoration of local production and living conditions, public service functions, and basic capabilities of self-development. The vast majority of the currently completed projects are urban and rural housing, schools, hospitals, kindergartens, homes for the elderly, transportation, and other livelihood projects.

A third contribution was in promoting employment in the disaster areas. Depending on the actual situation of the disaster areas, the donor provinces and cities carried out job training, site recruitment, and transfer of surplus labor from the disaster areas; they also helped to raise farmers' income and contributed to transitional placement and social stability. Hebei Province, for example, helped 1,010 surplus labors in Pingwu County find employment in Hebei Province, and it helped 5,266 workers in the disaster area find local employment.

A fourth contribution was in industrial reconstruction. Specifically, the donor provinces helped farmers resume production and increase their income; they also encouraged companies outside the province to participate in and support industrial development in the disaster areas and to support a range of industries, including breeding, planting, and processing of distinctive agriculture and animal husbandry products; mineral processing; tourism marketing; and tourism product development. They also supported infrastructure construction for the industrial park, encouraged implementation of the projects for which the enterprises had contracted, and generally promoted the recovery of industrial development in disaster areas.

The donor provinces' fifth contribution was to suggest a new development concept. It is clear that the counterpart support mechanism need not be limited to industrial reconstruction. Its success is a reminder that originality and innovation are the driving force behind development. The reconstruction project has effected social and cultural integration of Sichuan and the rest of the country, and the power of reconstruction has had a profound impact on the social ecology of the disaster areas. It would be beneficial for officials in the disaster areas to master as soon as possible both the concepts involved in developing a market economy and the methods of advanced management; they could then use this knowledge in postdisaster reconstruction and accelerated development of the disaster areas and in enhancing the areas' sustainable development potential.

## System for Postdisaster Reconstruction Organizational Implementation

### Organizational implementation as part of postdisaster reconstruction

*Government organization*

The governments authorized to exercise powers in the earthquake reconstruction process included the central government, the local government of the disaster area, and the local government carrying out the reconstruction. The three governments cooperated based on a division of labor described below.

The central position of the central government in postdisaster restoration and reconstruction was reflected in its responsibility for establishing postdisaster restoration and reconstru-ction institutions and for drawing on exp-eriences of other countries and regions to integrate and amend relevant laws and regulations to facilitate postdisaster reconstruction.

Various levels of local governments in the disaster area played a crucial role in the reconstruction process. They prepared annual plans for restoration and reconstruction, and implemented the main tasks. They also coordinated various efforts and actively raised funds to accelerate the pace of reconstruction.

Local governments outside the disaster area were tasked with the implementation of reconstruction support. Their success made the counterpart support system a major feature of China's postdisaster restoration and reconstruction system.

*Social forces*

All sectors of society were expected to participate in postearthquake reconstruction. According to the Wenchuan Earthquake Restoration and Reconstruction Ordinance, reconstruction was to be led by the government and to include participation by all social groups in industrial reconstruction, cultural reconstruction, ecological reconstruction, psychological reconstruction, and other types of reconstruction. The participation of all sectors of society was seen not only to complement government leadership, but also to play an essential role in supervision.

*Foreign governments and international organizations*

After the earthquake, to reduce the financial burden on disaster areas, make up for insufficient construction funds, and speed up restoration and reconstruction of infrastructure, the central government actively sought emergency loans and assistance from foreign governments, which were used to support a range of projects in the disaster area, including rural biogas, health and medicine, water ecology, and school reconstruction.

China also sought out preferential emergency loans from international financial organizations, which were designed for use in reconstruction of urban and rural public service utilities and infrastructure, environmental remediation, water resources and ecological restoration, and other aspects of postdisaster reconstruction in the 51 severely affected counties, cities, and districts in Sichuan, Shaanxi, and Gansu Provinces. The World Bank and Asian Devlopment Bank also offered aid in the form of draft policy recommendations on disaster restoration and reconstruction work, based on experience gained assisting other developing countries in natural disasters, and in the form of training to Chinese officials.

**Coordination mechanism for postdisaster reeconstruction**

Postdisaster restoration and reconstruction is a systematic project involving the participation of both various government departments at various levels and relevant groups such as the army, community groups, and so on.

Because reconstruction after the Wenchuan Earthquake posed unprecedented difficulties in coordination, the State Council set up the Wenchuan Earthquake Restoration and Reconstruction Coordination Group, led by the National Development and Reform Commission. The job of the group was to organize the relevant departments and local governments for coordination and communication according to the progress and problems of postdisaster restoration and reconstruction work. In addition, an interaction mechanism between government and nongovernmental organizations was established to guide nongovernmental organizations involved in reconstruction work under unified planning by the government; commission, contract, and other methods were used to form a rational labor division and coordination with the government's counterpart support.

### Management system for postdisaster reconstruction funds

*Establishment of postdisaster restoration and reconstruction funds*

After the earthquake, in order to solve the earthquake relief and reconstruction funding issues, the Ministry of Finance proposed establishment of postdisaster restoration and reconstruction funds. As indicated above, the central financing department was to arrange funding of Y 300 billion over three years and plan for the use of social donations and counterpart support funds, for a total of Y 1 trillion. Subsequently, the Ministry of Finance set up a special budget accounting department to ensure that the funds were earmarked.

*Establishment of an overall rationing system*

The Ministry of Finance adopted the overall rationing system described in the phrase "overall rationing for total flow, and control for different types." The postdisaster reconstruction funds were assigned into 1 of 10 categories and delivered to the three affected provinces and relevant departments. The affected provinces in turn delivered the funds to 51 severely affected counties using "overall rationing" and other methods and giving affected areas the authority to arrange the funds. The local governments arranged the usage of funds according to the planned tasks, local conditions, priorities, and other factors, to ensure that every capital construction material was used where need was most urgent and so as to maximize economic and social benefits.

*Establishment of an overall mechanism*

In addition to the postdisaster restoration and reconstruction funds established by the central government, there were other sources of funds for reconstruction. The Ministry of Finance proposed making overall arrangements for various types of reconstruction funds. Thus, an overall mechanism was established, one dominated by the central government's restoration and reconstruction funds and guiding the contribution of local governments, counterpart support, social donations, bank loans, and other types of reconstruction funds.

The coordinating mechanism focused on the power of the funds as a combined whole. Under the mechanism, the affected provinces were to comprehensively arrange the various disaster recovery and reconstruction funds; this step would help to integrate capital and postdisaster reconstruction planning, maximize the effects of all types of local coordinating funds, promote an organized and coherent disaster response (unlike certain reponses in the past), and greatly improve the efficiency of fund utilization.

*Establishment of innovative financing mechanisms*

To address the consequences of the earthquake, the central authorities used innovative financing mechanisms and multiple channels to raise needed funds. For example, they set up guarantee funds in addition to financial discounts to enable industrial and commercial enterprises to resume production and reconstruction; they positively brought a market mechanism into play, and encouraged and guided bank credit and other social capital to flow into reconstruction. The loan guarantee business supported by the central financing department for small and medium enterprises (SMEs) gave priority to disaster areas, encouraged the local governments to take a part of the central financing department's earthquake restoration and reconstruction funds as the guarantee, and actively sought support from international financial organizations and foreign governments.

**Supervision mechanisms for postdisaster reconstruction**

*Establishment of leading agencies for supervision of organizations*

To strengthen the supervision of relief funds and materials, the central government set up a supervision and inspection leading group specifically responsible for leadership in supervising relief funds and materials. The group was made up of members of the Central Commission for Discipline Inspection, the Ministry of Supervision, the Ministry of Civil Affairs, the Ministry of Finance, and the Audit Commission. Local governments in Sichuan and other affected areas also established leading agencies. The leading groups conscientiously performed their duties, held meetings to study and plan the work, and promptly established a sound monitoring and inspection system, described below.

*Establishment of a sound monitoring system with rules and regulations*

The introduction of rules and regulations for supervision of the earthquake relief funds and materials ensured that relief funds and materials would be appropriately and effectively used. The rules and regulations system operated as follows: first, as the central and local governments continually assessed the new situation and any new problems, and as they adjusted and refined the supervision and inspection system in response, a complete system of supervision and inspection regulations was gradually established. Second, the relevant departments sorted out the previous rules and regulations for management and use of earthquake relief and reconstruction funds and materials, which were then collected by the Ministry of Supervision; the relevant local governments and departments were urged to both be fully aware of and strictly implement the rules and regulations.

*Carrying out of special supervision and inspection*

Special supervision and inspection was an important means of strengthening the supervision of relief funds and materials. It called for the central and local governments to check every aspect of management of the disaster relief funds and materials management using special inspection, general inspection, focusing inspection, and sampling inspection.

Under special inspection procedures, the following steps were taken: (1) The key points of inpection were highlighted; (2) efforts were made to strengthen the special inspection of "the process for increasing revenues and decreasing expenditures and for exercising diligence and frugality;"[2] (3) donations received by or transferred among relevant governmental departments, social organizations, and mass organizations were subject to special inspection; (4) full use was made of the special inspection results, and relevant departments were urged to carefully rectify and correct the problems found in inspection, audit, and research.

*Implementation of sunshine monitoring mechanism*

As the saying goes, "Sunshine is the best antivirus agent." To ensure the rational use and effective supervision of relief funds and materials, the supervision and inspection leading group coordinated relevant departments to promptly disclose the procedures for the supervision and inspection system they had in place, and to arrange consultation calls, set up hotlines, and hold press conferences. The group called for an

2 This was a Chinese government initiative.

information disclosure system to publicize the source, type, quantity, and destination of earthquake relief funds and materials. The system was designed to give full play to the public's supervision rights; to permit supervision by the National People's Congress, the Chinese Communist Party Central Committee, democratic parties, press and other news media, and community; and guide social groups to participate in the supervision in an orderly way.

**Risk Management Mechanism for Post-disaster Reconstruction**

*Raising awareness of disaster prevention and relief*

Steps were taken to raise aware of techniques for disaster prevention and relief. A "Disaster Prevention and Relief Day" has been established to educate the public about emergency response and disaster prevention and relief. With the approval of the State Council, May 12 of each year is now known as "Disaster Prevention and Relief Day." In addition, material on public safety has been incorporated into the national education system; different programs are offered for children at different stages, from early childhood through higher education. All regions and departments have prepared an emergency response manual and delivered it to the basic organizational units in disaster areas and rural areas. The press and other media should be used to spread information about emergency response and to propagate emergency plans, not only to raise awareness of disaster prevention and relief but also to increase self-help and mutual-help abilities. Finally, a sound system of emergency management training should be established.

*Improving the emergency management system*

In view of problems with the emergency management system and mechanism in China, the State Council asked the State Commission Office for Public Sector Reform and other departments to conduct a special study of emergency management. It also made some suggestions for how to improve the emergency management agencies and strengthen the leadership of emergency management agencies and administrative bodies.

Central and local governments have focused on the construction of emergency management mechanisms. Specifically they have sought (1) to establish an information reporting and sharing mechanism; (2) to establish an emergency response linkage mechanism; (3) to improve the mechanism guiding public information; (4) to establish a social mobilization mechanism; and (5) to establish an international cooperation mechanism.

*Improving disaster prevention and relief abilities in rural and urban areas*

In the postdisaster restoration and reconstruction process, the central and local governments took strong measures to effectively improve the disaster prevention and relief abilities in rural and urban areas. First, they sought to strengthen the project quality safety by strictly implementing the state's new anti-earthquake standards and by design rural housing, schools, hospitals, and other high-occupancy public service facilities according to higher requirements than the local seismic resistance requirements for housing construction. In carrying out the basic construction procedures, they also sought to strictly implement the system establishing legal accountability, the bidding system, the contract management system, and the project supervision system. Finally, they sought to strengthen construction safety by ensuring that all postdisaster restoration and reconstruction projects were implemented in accordance with the overall plan for postdisaster reconstruction and that the statutory basic construction procedures were strictly carried out.

## Rough Evaluation of Reconstruction's Overall Effect

Under the leadership of the party central committee and the State Council, supported by the hard work of officials and the public alike, the restoration and reconstruction work has gone well and has achieved the stated objective of "basically completing the three-year job in two years." The reconstruction has resulted in enormous changes in the affected aresa. Today, the former disaster areas have "the most beautiful houses, the most solid schools, the most modern hospitals, and the most satisfied people."[3] The restoration and reconstruction in disaster areas have met with the residents' approval, received very high marks from the local community, and won extensive praise from the international community.

A total of Y 1,020.5 billion was invested in the restoration and reconstruction, of which the central financing department arranged Y 302.6 billion as the postdisaster reconstruction funds. Currently, construction is underway for all the projects in the disaster areas of Sichuan, Shaanxi, and Gansu Provinces that were included in the national plan. Completed projects account for 95 percent of the planned projects; moreover, completed investment is as high as 95 percent of the total planned investment. The main tasks of postdisaster restoration and reconstruction have been completed, and economic and social development, as well as basic working and living conditions, are significantly better in the affected areas than they were before the disaster. The reconstruction objectives proposed in the overall plan for reconstruction – "Every family has housing, every household has employment, everyone is safe, facilities are improved, the economy is developed, and ecology is improved" – have basically been realized, and a decisive victory for postdisaster restoration and reconstruction has been won.

**Improvements in urban and rural housing**

After nearly three years of effort, urban and rural housing reconstruction tasks have been completed and the housing problems of the disaster areas have been properly addressed. The living conditions of urban and rural residents have improved significantly; they are now better than they were before the earthquake. The housing layout is more rational, and there are more comprehensive functions and supportive services; the housing itself is safe, beautiful, practical, and economical. Many peasants now have water-pipline facilities at home and have access to tap water, a fundamental change in the way of life for many. The completion of urban and rural housing reconstruction has significantly contributed to restoring the quake-stricken areas to normal production and living conditions. It has improved people's livelihoods in disaster areas, fostered social stability, and promoted stable and healthy economic and social development.

Reconstructed housing in Yingxiu Town is shown in figures 2.1 – 2.5. The new look of Shuimo Town after reconstruction is shown in figures 2.6 and 2.7; figures 2.8 – 2.10 show Wenchuan Town before and after the earthquake; figures 2.11 – 2.13 show Dujiang Weir before and after the earthquake.

3 The description is from a speech by Wen Jiabao given in May 9, 2011, and available at http://news.xinhuanet.com/politics/2011-05/10/c_121396310.htm


**Figure 2.1 House in Yingxiu Town after Reconstruction Aided by Dongguan Counterpart Support**

Source: Authors.

**Figure 2.2 Reconstructed Houses in Yingxiu Town Facing Wide New Street**

Source: Authors.

**Figure 2.3　Another View of Reconstructed Houses in Yingxiu Town**

Source: Authors.

**Figure 2.4　Flags Flying Atop Reconstructed Houses in Yingxiu Town**

Source: Authors.

**Figure 2.5　Reconstructed Houses in Yingxiu Town Facing the River**

Source: Authors.


**Figure 2.6　The New Look of Shuimo Town after Reconstruction**

Source: Authors.

**Figure 2.7　Scenes from Shuimo Town after Reconstruction**

Source: Authors.

**Figure 2.8　Wenchuan Town before the Earthquake**

Source: http://news.qq.com/a/20080519/003763_7.htm.

**Figure 2.9　Wenchuan Town after the Earthquake**

Source: http://news.qq.com/a/20080519/003763_7.htm.


**Figure 2.10　The New Look of Wenchuan Town after Reconstruction**

Source: http://bbs.hsw.cn/read－htm－tid－811948.html.

**Figure 2.11　Dujiang Weir before the Earthquake**

Source: http://news.qq.com/a/20080519/003763_7.htm.

**Figure 2.12　Dujiang Weir after the Earthquake**

Source: http://news.qq.com/a/20080519/003763_7.htm.

**Figure 2.13 Qipan Village, Xiange Town, Dujiang Weir, after Reconstruction**

Source: http://www.tjwq.gov.cn/system/2009/05/07/010121176.shtml.

**Improvements in infrastructure**

Currently, the transportation, communications, energy, water, and other types of infrastructure have been fully restored in the disaster areas, and a large number of other major infrastructure projects associated with long-term development in the disaster areas have been completed. The ecology of the region is gradually being restored, environmental management is being strengthened, and disaster prevention and relief capabilities are being enhanced. The key reconstructed towns have a new look; the disorderly village layout of the past is gone. The towns and rural settlements not only have beautiful houses, but also offer some fitness facilities and cultural facilities.

Figures 2.14–2.15 show roadways in Wenchuan immediately after the earthquake and then after reconstruction.

**Improvements in public services**

In the reconstruction of public services, the goal was to strengthen the integration of resources, optimize layout, strictly implement mandatory standards, and allocate reconstruction funds so as to ensure the completion of the safest and most solid buildings. The damaged schools and hospitals have been fully reconstructed, and a large number of social welfare facilities, nursing homes, community centers, village centers, and other public service facilities have been established. The seismic fortification standards of schools, hospitals, and other buildings have been increased from VII (7) to VIII (8) degrees, and in addition to being stronger and safer the buildings also have significantly improved facilities and equipment. Many schools, including Beichuan Middle School (shown right after the earthquake and then after reconstruction in figures 2.16–2.18), have bright and


**Figure 2.14 Roadway in Wenchuan Disaster Area after the Earthquake**

Source: http://auto.qq.com/a/20090511/000151_1.htm.

**Figure 2.15 Roadways in Wenchuan Disaster Area after Reconstruction**

Source: http://zhcj.jinmajia.com/article/hyxw/200812/20081200001511.shtml.

spacious classrooms and dorms, and have also added laboratories, libraries, and playgrounds. Overall, the public service capabilities of disaster areas have been significantly enhanced, and equalization of basic public services has been promoted.

**Boosting of industrial development**

To promote economic recovery after the blow dealt by the Wenchuan Earthquake, China combined industrial reconstruction with the transformation of economic development, adjustment of industrial structure, and optimization of the industrial layout. All the damaged enterprises have now resumed production, and the industrial restructuring and optimization have taken significant steps to eliminate backward production capacities, build characteristic industrial parks, and form industrial clusters. Agricultural production

**Figure 2.16 Beichuan Middle School before the Earthquake**

Source: http://news.qq.com/a/20080519/003763_7.htm.

**Figure 2.17 Beichuan Middle School after the Earthquake**

Source: http://news.qq.com/a/20080519/003763_7.htm.


**Figure 2.18 Scenes from the New Beichuan Middle School**

Source: http://club.china.com/data/thread/26154256/2717/32/40/7_1.html.

facilities and the agricultural service system have been fully restored, and a number of local unique agricultural production bases have been developed. Some of the reconstructed industry is shown in figures 2.19 – 2.21.


**Figure 2.19  Deyang Dongfang Steam Turbine Works after Reconstruction**

Source: http://gb.cri.cn/27824/2010/02/03/3365s2749805.htm.

**Figure 2.20  Soilless Culture Workshop in the Beichuan Vista Modern Agricultural High-Tech Demonstration District**

Source: http://mybc.newssc.org/system/20100520/000902684.html.

**Figure 2.21 Display Flowers in the Beichuan Vista Modern Agricultural High-Tech Demonstration District**

Source: http://mybc.newssc.org/system/20100520/000902684.html.

**Treating residents' psychcological trauma**

In the reconstruction process, the Chinese government recognized the importance of treating people's emotional and psychological injuries, and it implemented psychosocial rehabilitation projects along with physical reconstruction. Residents are recovering from the disaster and are regaining confidence and optimism.

# 3

# Foreign Approaches to Postdisaster Reconstruction

Countries beside China are at risk of earthquake and other natural disasters by virtue of their geographic and geologic situation. The United States and Japan, for instance, both have abundant experience in earthquakes and in postdisaster reconstruction. This chapter draws on the experiences of 10 foreign countries that have implemented postdisaster reconstruction projects and categorizes the basic approaches, key policies, and management frameworks they adopted.[1] It also summarizes some lessons offered by foreign experiences with postdisaster reconstruction and explores their implications for China.

## Foreign Postdisaster Reconstruction Lessons

### Problems with disaster prevention and mitigation systems

*Absence of real-time and effective early warning mechanism*

Predisaster warning is an important part of the disaster reconstruction and mitigation process. An effective early warning mech-anism can help to nip disasters in the bud and reduce the losses caused by disasters. However, the absence of early warning mechanisms is all too common. For example, Central Java, Indonesia, suffered a 5.9-magnitude earthquake in 2006, but it did not have seismography equipment installed and received no early warning signal before the earthquake. Thus people were caught unprepared and unawares, and the resulting toll in human lives and property losses was unnecessarily high.

*Limited public awareness of disaster reconstruction and mitigation*

Some countries have failed to make the public sufficiently aware of how to prepare for and respond to a disaster. The Indonesian government, for example, did not offer the public education on disaster reconstruction and mitigation, and did not conduct disaster prevention exercises. The earthquake and tsunami in 2004 caused heavy casualties in

1 The countries include five developed countries and five developing countries. In the first category are Japan (Hanshin-Awaji or "Great Hanshin" Earthquake), the United States (earthquake and hurricane), New Zealand (earthquake), Russian Federation (emergency response system), and Australia (postdisaster reconstruction and organization system). In the second category are Pakistan (South Asian Earthquake), Indonesia (earthquake and tsunami), India (Gujarat Earthquake), Chile (earthquake), and Turkey (earthquake). See appendix 1 for the details of the Hanshin-Awaji Earthquake; see appendix 2 for the details of the South Asian Earthquake in Pakistan.

part because residents had no knowledge of disaster prevention or escape, and did not know how to respond to the situation or how to protect themselves.

*Corruption and poor oversight*

In countries where housing is of poor quality and low seismic performance, earthquakes have caused the collapse of a large number of houses and resulted in heavy casualties. In Indonesia and Pakistan, for example, there is evidence that some building contractors did shoddy work and used inferior materials, which resulted in the inferior quality of infrastructure buildings. Moreover, the officials in charge of the building projects took kickbacks, and project coordinators did not perform their duties faithfully. The collapse of buildings in several universities and the government's finance bureau in Yogyakarta, Indonesia, following the 2006 earthquake shows the risks of failing to build to standard. In recent years, as "jerry-built" structures in seismic areas have become more common, so too have earthquake-induced casualties and building collapse.

*Weak crisis-assessment capacity*

Weak crisis-assessment capacity and inaccurate assessment can delay timely relief and postdisaster reconstruction. In Pakistan, for example, which has no permanent crisis assessment agencies, the emergency response agencies organized temporarily following disasters have not been competent to carry out crisis assessment. After the earthquake in Pakistan, serious underestimations of the degree of disaster damage impeded the smooth delivery of disaster relief. Japan and Chile both turned down offers of foreign aid due to inaccurate crisis assessment in disasters; when they realized that the actual losses were beyond their own capacity to address, they found the international community was no longer so ready to offer aid.

**Problems with governments' postdisaster emergency organization capacity**

*Poor organization as cause of delayed relief*

The poor organization and resulting slow action of governments following disasters can make delievery of relief slower and less efficient than it should be. For example, after the 2006 5.9 magnitude earthquake in Jogia, Indonesia, and in some areas of Central Java, the government's poor organization led to inefficient emergency rescue efforts, and the slow relief response of central government departments and local governments meant that those wounded in the earthquake did not receive timely treatment, which increased the number of deaths. There were reports of earthquake victims groaning and begging for food and water for long periods before receiving aid.

*Lack of coordination among governments at various levels*

The uncoordinated and inconsistent actions of government departments at various levels can frustrate efforts to ensure a unified response to disaster and impede efficiency. Following the Great Hanshin Earthquake, for example, crisis management was properly coordinated from the top down. Unfortunately, the absence of horizontal contact and coordination among departments, and departments' shirking of responsibility, meant that disaster prevention and relief tasks could not be distributed horizontally. This situation frustrated the formation of unified command and slowed down the rescue.

*Lack of long-term vision in postdisaster reconstruction*

The increasing losses caused by natural disasters are in part due to governments' lack of long-term vision for disaster mitigation and their eagerness for instant success and short-term benefits in postdisaster reconstruction. Following emergencies, some governments have simply repaired damaged houses and failed to consider antiseismic construction, pursing quantity more than quality. Some governments have even built or rebuilt homes in obviously unsuitable places because site selection did not include a scientific evaluation process. Thus when another disaster occurs, another tragedy will be unavoidable.

*Rigid policies at odds with foreign aid*

Governments' refusal of foreign aid can unnecessarily protract postearthquake rescue work. After the 2010 8.8 magnitude earthquake in Chile, for example, the government declared that it could cope with the disaster independently and did not need the aid of the international community. But the losses caused by the disaster – amounting to US $30.0 billion – went far beyond Chile's capacities. The government did appeal for international aid at that point, but the prime period for carrying out the rescue work had been missed, and the rescue was not able to accomplish very much.

**Problems in postdisaster reconstruction**

*Problems with receipt, disbursement, and use of relief funds*

Lack of unified fund management can create problems in using funds promptly and effectively. There is evidence of governments failing to make timely disbursement of relief funds to affected people, using the funds secretly for unintended purposes, or even embezzling the funds. Kickbacks and other forms of corruption are common. For example, some government officials in Indonesia were found misappropriating international relief funds after a disaster there.

*Problems in postdisaster citizens resettlement*

Conflicts between government and affected people are common after a disaster when citizens are being resettled. When the government fails to communicate with the affected population about migration issues and unilaterally makes decisions without consulting the people involved, the migration planning is likely to prove unpopular. Moreover, if the government changes the migration articles arbitrarily, then the people affected are likely to feel deceived or mistreated, and the government's credibility suffers. The result is greater-than-necessary conflict in an already fraught and difficult situation.

*Inattention to environmental remediation*

Postdisaster reconstruction means not only the rehabilitation of buildings and infrastructure, but also the restoration of the ecological system. Reconstruction should foster harmony between human beings and the natural environment. Some countries do not pay sufficient attention to the restoration of the ecological environment. In Japan, for instance, after the Great Hanshin Earthquake, hazardous chemicals and even rotting corpses were allowed to penetrate the soil and to pollute the groundwater. The result was contamination of people's drinking water; in addition, radioactive materials also directly endangered people's health. The pollution left by the Great Hanshin Earthquake remains a problem to this day.

*Inattention to long-term psychological issues*

The pain experienced by survivors of disasters may take years or even decades to heal. It is not unusual for surviors struggling with postdisaster phobias, depression, and other psychological problems to commit suicide. For example, some research suggests that the number of Japanese who died for reasons related to depression climbed in the years after the Great Hanshin Earthquake. Some countries offered psychological treatment only during the immediate aftermath of the catastrophe but not once the rescue period was over. This limited treatment made it harder for survivors to devote themselves to the postdisaster reconstruction, and affected the progress of the reconstruction work.

*Inattention to ongoing needs of affected people*

In the immediate aftermath of a disaster, the affected population may feel deeply cared for, as they experience the government's dedication to rescue efforts, see continuous reports of the disaster on the news, understand that there is a global focus on the disaster-hit areas, and recognize that money and material donations are coming from their own and other countries. In the longer term, however, the media focus shifts away from affected people, donations slow down, and the government's attention turns elsewhere, even when the long-term or basic needs of affected people are not being met. There have been instances of residents of disaster area lacking sufficient food and clothing, which has affected their confidence and determination to rebuild their homes.

## References and Implications

### The importance of disaster reconstruction and mitigation mechanisms

*Improvements to the legislative process and legal system*

Sound laws secure the work of postdisaster relief and reconstruction. Japan, for example, has 24 earthquake-related laws, which guide the work in stages after disasters. China on the other hand has only two earthquake-related laws (the Law on Precautions against Earthquake and Relief of Disasters; and the Emergency Response Law), which in practice could not be used to guide specific disaster relief work or to assign responsibilities to specific persons. Moreover, China lacks laws regarding postearthquake reconstruction. China should learn from foreign practices and enact disaster-related laws so that postdisaster reconstruction can proceed in stages based on specific laws and regulations.

*Importance of a crisis early-warning mechanism*

A crisis early-warning mechanism is a necessary precondition for disaster prevention and mitigation. China currently uses mainly the expert forecasting method for early warning, so that there is still a gap between China and developed countries like the United States and Japan. Establishing a crisis early-warning mechanism should be done as follows:

First, laws regarding crisis management should be formulated. China should learn from foreign practices and draft laws similar to Japan's Disaster Countermeasures Basic Act; this would incorporate crisis management into the legal system and define the responsibilities and obligations of crisis management executors, specify countermeasures for disasters, and outline the crisis management system as well as the policies and ordinances for responding to a crisis.

Next, a modern transmission system for managing crisis early-warning information should be set up. This system would perform the same role as America's 911 and the European Union's 112 emergency response center, and could take advantage of the network system to mobilize and arrange the relief agencies nearest to the place where the disaster occurs, thus bringing help in the shortest possible time.

The last step is to set up the disaster prevention and warning communities such as currently exist in the United States. Following the U. S. example, China should use the communities to educate residents about disaster warning signs and about methods of surviving or escaping a disaster.

*Importance of an emergency organization system*

Foreign countries like Japan and the United States have relatively effective emergency organization agencies. Japan's cabinet has set up a disaster response headquarters, where the prime minister serves as the supreme commander for overall planning and coordination. Provinces, cities, and districts have special crisis management departments headed by the supreme leaders of the provinces, cities, and districts, who take full charge of the handling of various disasters. America's emergency organization system consists of the Department of Homeland Security, the Federal Emergency Management Agency, the Emergency Incident Command System, the disaster agencies of state governments, and emergency depart-ments of cities and counties; together these form a unified command system. In case of disasters, the Federal Emergency Management Agency will conduct unified coordination and command of relevant departments. China should set up a special emergency command system similar to that of Japan and America.

*Public education on disaster reconstruction and mitigation*

Both the United States and Japan begin educating the public about disaster reconstruction and mitigation in elementary school. They conduct regular disaster drills and treat disaster reconstruction and mitigation as routine work. China should learn from them: it should strengthen its efforts to publicize and offer education in disaster prevention issues, and should carry out earthquake drills on a regular basis. It could also copy the practice of New Zealand and arrange special museum exhibits that teach visitors about disaster prevention free of charge.

*Importance of the disaster prevention and mitigation risk assessment system*

China should avoid the experiences of Pakistan, which has no risk assessment agencies, and should set up a special agency to address earthquake preparedness and disaster risk reduction. The agency should be staffed by experts from many fields who would assess and research various disaster risks and determine the funds required for the various stages of postdisaster reconstruction.

*Importance of sufficient seismic and earthquake-resistance standards of buildings*

The building laws of countries such as Japan, New Zealand, and Chile, to name only a few, have strict requirements for the seismic standards of buildings. After the Great Hanshin Earthquake, Japan revised its building law three times, requiring that office buildings have seismic fortification of VIII (8) degrees and a service life of over 100 years. New Zealand has relatively high requirements for the seismic standards of housing; as a result, there were no deaths reported in the 7.1 magnitude earthquake in September 2010. China should learn from the practices of these countries and revise the building law to strengthen the seismic standards of housing construction.

**Importance of government and social organizations in disaster relief and post-disaster reconstruction**

*Improving the government's organization and strain capacity*

China should draw on lessons from both Hurricane Mitch in Central America in 1998 and the Indonesian earthquake of 2006. In both these cases, the best time for rescue was missed because of the government's poor organization and moderate response efforts, as well as slow relief efforts by government departments at all levels. The Chinese government should improve its organization capacity in case of disaster – that is, the government should be able to mobilize troops, police, fire fighters, and different social groups to carry out the rescue and to minimize disaster losses to the utmost.

*Making full use of NGOs and volunteers in postdisaster relief and reconstruction*

When disaster strikes in many countries around the world, there is a rapid response by NGOs and volunteers, who arrive at the disaster site with relief supplies to meet the urgent needs of affected people, offer to cooperate fully with the government, and in general play an irreplaceable role in disaster relief and reconstruction. China should learn from these countries, and make full use of civil organizations and volunteers in disaster relief.

*Making full use of international rescue*

China should draw on lessons from Japan, which turned down international rescue assistance following the Great Hanshin Earthquake, and from Pakistan and Indonesia, which made full use of international rescue assistance in their postdisaster reconstruction. In any future disaster, China should appeal to the international community for aid and make full use of international rescue assistance.

**Making full use of public finance in disaster relief and postdisaster reconstruction**

Since natural disasters affect public facilities and public goods, the market mechanism does not fully work in responding to them; public finance as the investor of public products should naturally undertake the burden of disaster relief and postdisaster reconstruction. The finance department therefore plays a decisive role in disaster relief and postdisaster reconstruction.

*Crisis management bodies in the finance sector*

Crisis management network bodies should be set up in the finance sector. These bodies, which would include legal research bodies dealing with financial payment, risk warning and assessment bodies, emergency budget bodies, and others, would conduct the legal research on the financial budget and risk assessment, draft the financial emergency plans, define the emergency responsibility of central and local finance departments, and guarantee the timely disbursement of funds to allow immediate investments in disaster relief and postdisaster reconstruction.

*Improving the reserve system*

The reserve system should be improved in two ways. First, the withdrawal proportion of reserves should be increased. Foreign countries like the United States and Japan manage the financial budget emergency funds separately from the general budget funds. The U. S. federal and state governments have a special financial budget appropriation for disaster resistance and relief, and the annual financial emergency budget is more than US $ 3.0 billion. After the Great Hanshin Earthquake, Japan increased the withdrawal amount of budget emergency funds. Its annual financial budget emergency fund is around ¥34.0 billion, around 5 percent of the annual budget. Moreover, Japan stipulated that in case of catastrophic disasters, the central government would increase the subsidy to affected areas to alleviate the burden of local finance. The Budget Law of China, on the other hand stipulates that "governments at various levels shall draw the reserve at 1 percent ~ 3 percent of the budget expenditure of corresponding level for the natural disaster expenditure in budget implementation of that year and other unpredictable special expenditures." In some especially severe disasters, such as the Wenchuan Earthquake, the reserve drawn at 1 percent to 3 percent was far from what the disaster required. In addition, the current bundled management of reserves and annual budget has reduced the emergency role of reserves significanlty.

The examples of the U. S. and Japanese reserve management systems suggest both that the financial emergency budget funds should be managed separately and that the withdrawal proportion of reserves should be increased to improve the emergency response capabilities of finance.

The second improvement to the reserve system would entail implementing a fund-style management approach. Currently, China manages reserves using a flow approach – that is, the unused or remaining reserves in a year when there is no disaster or only minor disasters are not carried forward to the next year for use, but are used to make up other expenditures. In case of especially severe disasters, the flow management of reserves cannot meet the demand for funds. This problem can be addressed by (1) implementing a fund-style management of reserves, and carrying forward the balance of the reserves to the reserve funds for next year; and (2) by implementing rolling management of the fund, and using it only for financial emergencies.

*Optimizing the investment structure of financial funds in emergencies*

Insufficient investment in predisaster prevention increases the cost of dealing with the disaster itself and the cost of postdisaster reconstruction. The government financial funds should be rationally structured so that the relative importance of each component – predisaster warning, disaster relief, and postdisaster reconstruction – is reflected in its share. It is particularly important to ensure the absolute proportion of early warning investment to reduce the occurrence of disasters from the source, since only in this way can public finance serve as the first line of defense in a crisis response.

*Strengthening supervision of financial funds in emergencies*

China should assiduously avoid a situation such as that of Indonesia, where fund use after the earthquake and tsunami in 2004 was marked by corruption and irregularities. China's Audit Office should strengthen the supervision of and audit process for emergency funds before, during, and after disasters to make the use of funds transparent, to avoid corruption, and to improve fund use efficiency.

**Diversification of postdisaster reconstruction funding sources**

Postdisaster reconstruction is enormously expensive, generally running up to several or hundreds of billions, and cannot be met entirely with the financial funds. Therefore, it is necessary to raise funds through several channels to meet the funding needs of postdisaster reconstruction.

As table 3.1 shows, about 30 percent of the reconstruction funds for Japan, Indonesia, and Chile came from financial investment; the remaining 70 percent was mainly acquired from compensation from earthquake insurance, bank loans, bonds issued, global donations, and other sources. China should learn from postdisaster reconstruction experiences of other countries and adopt diversified financing methods to raise funds and alleviate financial pressure. Concrete proposals are given below.

**Table 3.1 Financial Investments of Three Foreign Governments in Postdisaster Reconstruction**

| | Total investment in postdisaster reconstruction | Financial investment | Proportion of financial investment (%) |
|---|---|---|---|
| 1995 Great Hanshin Earthquake in Japan | ¥1.63 billion | ¥0.502 billion | 30.80 |
| 2004 Earthquake in Indonesia | US$8.0 billion | US$2.800 billion | 35.00 |
| 2010 Earthquake in Chile | US$30.0 billion | US$8.431 billion | 28.10 |

Source: Authors' compilation based on the following: National Development and Reform Commission, Department of Foreign Affairs, "Japan's Postdisaster Reconstruction Experience and Lessons," *Journal of China Economics* 16 (2008); Wang Dai and Zhang Wenzhong, "Multi-International Cooperation to Promote Disaster Reconstruction," *World Regional Studies* 19, no. 2 (2010); and "Chile President Announced the Postquake Reconstruction Financing Plan," April 17, 2010, http//news.xinhuanet.com.

*Earthquake insurance*

China should follow the practice of Japan, the United States, New Zealand, Turkey, and Chile and set up earthquake insurance. In this way it can avoid overreliance on financial funds for postdisaster losses and spread the earthquake loss risk more effeciently.

*Financial appropriation, government loans, and syndicated loans*

Because financial funds will rarely meet the needs of postdisaster reconstruction, China should be prepared to apply to foreign governments and financial institutions (for example, consortiums of banks) for loans to meet the financing needs.

*Capital market*

Funding for postdisaster reconstruction should rely in part on the capital market. China should make full use of the capital market to transfer funds continuously to the reconstruction units in disaster areas, as follows: It should issue bonds at home and abroad to fund postdisaster reconstruction, following the practices of Japan (which issued bonds in the amount of ￥880.0 billion to establish the Hanshin Renaissance Fund) and Chile. It should also raise funds through issuing stock. Related securities laws and company laws should add articles to allow enterprises affected by a disaster to set up a financing scheme, to lower the listing threshold of recon-struction projects, to shorten the examination and approval procedures of stock financing, to relax the credit rating of livelihood-related enterprises in disaster-hit areas, to increase the financing amount, and to reduce the flotation costs. Finally, it should make use of innovative financial instruments – for example, it should issue asset securitized products and design financial derivatives for the reconstruction of disaster-hit areas, such as future, option, bond, and risk portfolio swap, to raise funds for reconstruction and spread the disaster losses through the capital market.

**Lessons from effective foreign practices in postdisaster reconstruction**

*Community reconstruction*

Self-reconstruction as practiced in Pakistan and the community reconstruction in Kobe, Japan, are in fact the same. Both involved residents in disaster areas in participating in postdisaster reconstruction of homes. China should encourage affected people to build their homes with the fund support offered by the government in order to improve reconstruction efficiency in disaster areas.

*BOT in infrastructure reconstruction*

The built-operate-transfer (BOT) mechanism is used mainly with infrastructure such as utilities, as follows: upon completion of a project, the contractor collects the investment through operation for a set period, and when that expires hands over the project to the host country. Since reconstruction of infrastructure lends itself to the BOT model, the model should be adopted to reduce reliance on government funds.

*Strategies for postdisaster industrial reconstruction*

The neglect of industrial upgrading in the course of the industrial reconstruction that followed the Great Hanshin Earthquake was a mistake. China should make upgrading of industrial structure an important priority and should seek to merge and restrict related industries, eliminate backward production capacity (that is, high energy consumption coupled with low efficiency), support the development of emerging enterprises with potential for growth, and strengthen policy support to projects whose structural adjustment complies with the orientation of industrial policies. China should also follow the practice of Japan and support small and medium-size enterprises by increasing investment in them and relaxing financing conditions for them.

*Ecological restoration of disaster areas*

China should avoid the example of Japan and pay attention to ecological reconstruction. It should seek to protect the ecological environment from the impact of disasters and create a sound working and living environ-ment for residents. Specifically, it should restore the vegetation destroyed, strengthen pollution controls, block radiation sources, and detect and address any contamination of soil and water.

*Postdisaster psychological rehabilitation*

Psychological rehabilitation after a disaster is an important long-term mission and should not be ignored. China should arrange for psychiatrists to visit disaster areas, pay particular attention to the mental health of the elderly and children, and offer one-on-one treatment where appropriate.

*Avoidance of secondary disasters*

It is not uncommon for countries to ignore the risk of secondary disasters, such as aftershocks, landslides, debris flow, and flood, even though these may do more harm than the initial disaster, both to residents and to reconstruction projects. Governments at various levels should increase the investment in disaster prevention and control with a particular focus on the risks posed by secondary disasters.

**Lessons from foreign innovations in postdisaster reconstruction**

*Importance of predisaster preparation*

China should educate its people about natural disasters as other countries do. Japan, for example, holds earthquake drills across the country during disaster prevention weeks and disaster prevention days, arranges for experts to lecture on disaster prevention and response, and (like the United States and New Zealand) begins disaster training for children in elementary school. China should also set strict seismic standards for buildings. In case of any losses, the personnel in charge of design and construction should be investigated, as is the practice in Japan, the United States, Chile, and New Zealand. It should also ensure sufficient predisaster preventative funding, as is the practice in the United States, where the disaster prevention expenditure is as much as 25 of total disaster-related expenditures.

*Comprehensive and systematic postdisaster reconstruction planning*

Proper postdisaster reconstruction planning is necessary for the success of postdisaster reconstruction. Planning was key after the Great Hanshin Earthquake, when Hyogo developed the Hanshin-Awaji earthquake recovery plan, to define the basic policies, ideas, targets, system of governance, and budget plan of the reconstruction for 10 years after the disaster. Planning after the Indonesia earthquake and tsunami made it possible for international aid to be most effective and ensured the orderly progress of postdisaster reconstruction.

*Diversified mechanism for coordinating postdis-aster reconstruction*

A diversified coordination mechanism is helpful for ensuring that advanced concepts and management experiences guide the reconstruction of disaster areas, and for improving the postdisaster reconstruction efficiency. China should cooperate with countries that have extensive experience in postdisaster reconstruction and consider establishing a postdisaster reconstruction coordination mechanism with the United States and Japan.

*Assessment of reconstruction policies*

Reconstruction should take public opinion into account. China should arrange the order of reconstruction projects to reflect the preferences of the affected population. Regular surveys of residents can provide information about the effects of reconstruction and allow adjustments to be made where public opinion indicates they are needed.

# 4

# Conclusions and Proposals

China's postdisaster reconstruction experience suggests that though there were some minor problems as work was carried out, problems can be overcome by acknowledging them, strengthening the postdisaster reconstruction institutional structure, and perfecting the postdisaster reconstruction policy system.

## Characteristics and Experiences of China's Postdisaster Reconstruction

China's postdisaster reconstruction was influenced by its national situation as well as by particular circumstances. China's post-disaster reconstruction experiences, which reflect the indomitable spirit of the Chinese, offer valuable lessons for future postdisaster reconstruction.

**1. Promulgate programmatic documents such as postdisaster reconstruction laws, regulations, and plans.**

The complexity and difficulty of postdisaster reconstruction militates against pursuit of quick results, and blindly aggressive implementation should of course be avoided. One of China's important postdisaster reconstruction experiences has to do with the compilation of laws and plans related to postdisaster reconstruction. Shortly after the Wenchuan Earthquake in 2008, Premier Wen Jiabao signed Decree No. 526 of the State Council, the Regulations on Post-Wenchuan Earthquake Rehabilitation and Reconstruction, which are the first regula-tions in China specifically for postearthquake rehabilitation and reconstruction of a certain area and the first incorporation of postdisaster rehabilitation and reconstruction into the legal system. Based on these regulations, the State Council successively issued the Opinions on Supporting the Post-Wenchuan Earthquake Rehabilitation and Reconstruction Policies and Measures, Guiding Opinions on the Fulfillment of Post-Wenchuan Earthquake Rehabilitation and Reconstruction, and the Circular on the Issue of the General Planning for Post-Wenchuan Earthquake Rehabilitation and Reconstruction.

Documents of this kind were also issued in later disasters. After the occurrence of the Yushu Earthquake in April 2010, the State Council issued the Guiding Opinions on the Fulfillment of Post-Yushu Earthquake Rehabilitation and Reconstruction, Opinions on Supporting the Post-Yushu Earthquake Rehabilitation and Reconstruction Policies and Measures, and the Circular on the Issue of the General Planning for Post-Yushu Earthquake Rehabilitation and Reconstruction. In August 2010, after the debris-flow disaster in Zhouqu, Gansu, the State Council issued the Opinions on Supporting the Post-Zhouqu Disaster Rehabilitation and Reconstruction Policies and Measures and the Circular on the Issue of the General Planning for Post-Zhouqu Disaster Rehabilitation and Reconstruction.

Under the guidance of the State Council's planning documents and pertinent opinions, relevant departments and local governments also issued a series of special plans for postdisaster reconstruction, such as the Plan of Sichuan Province for the Implementation of Post-Wenchuan Earthquake Rehabilitation and Reconstruction Program; this plan was developed by Sichuan Province in light of the general planning and special planning of the state. The promulgation of these planning and policy documents has ensured that post-disaster reconstruction proceeds systematically, on schedule, efficiently, rapidly, and with a scientific basis.

**2. Implement vigorous fiscal policies.**

The State Council pointed out explicitly in pertinent documents that postdisaster rehabilitation and reconstruction should combine a leading role for government with participation by society as a whole. The government's leading role has not only involved overseeing, organizing, and coordinating rehabilitation and reconstruction, but has also and even more importantly involved guidance of government funds and follow-up supportive fiscal and tax policies, to ensure sound and rapid development of disaster areas.

After the Wenchuan Earthquake, central finance set up the postearthquake rehabilitation and reconstruction fund and required provincial finance departments to establish comparable funds. The central government allocated Y 300 billion from the postdisaster reconstruction fund for postearthquake reconstruction.

Besides direct vigorous fiscal investment policies, China has also implemented extensive and preferential tax policies and measures to support the postdisaster reconstruction, including the following: reducing the tax burden of enterprises in disaster areas, exempting the residents of disaster areas and first responders in disaster relief from the individual income tax on income relating to disaster relief; adopting preferential tax policies to support the rehabilitation and reconstruction of urban and rural housing and infrastructure; encouraging all sectors of society to support disaster relief and postdisaster rehabilitation and reconstruction; exempting the enterprises, units, and individuals making donations from related taxes; implementing preferential tax policies promoting employment; and waiving related administrative charges and government fees in the course of postdisaster rehabilitation and reconstruction.

**3. Enlist the aid of local governments.**

As part of its effort to mobilize the whole nation to boost postdisaster rehabilitation and reconstruction, the central government devised the counterpart support ("twin assistance") mechanism.

The mechanism had three advantages. First, it could be put int effect immediately. Even before the promulgation of the general planning, the provinces giving assistance to specific areas entered the disaster areas to consult on reconstruction projects. Once the plan was defined, the donor provinces' manpower, materials, and funds were available immediately and project implementation could be organized. Second, it unified "hard" support and "soft" support. In addition to funds, the donor provinces and cities provided their technology, management, and other skills to support plan preparation, survey design, manpower training, and related needs. Third, the mechanism unified "blood transfusion" and "blood creation." Donor provinces were involved in both "turnkey" and "check transfer" projects. They actively planned for industrial reconstruction and development while solving current livelihood issues, encouraged local enterprises to cooperate with disaster areas through market-oriented methods, and helped assisted areas to enhance their long-term development capacity.

The counterpart support mechanism grew out of China's social and political systems and was part of what gave the postdisaster reconstruction work distinctively Chinese characteristics.

**4. Pay attention to livelihood and industrial development.**

China has prioritized both people's livelihood and industrial development in postdisaster reconstruction, and has allocated a majority of reconstruction funds to these areas. The first article of State Council planning documents for Wenchuan, Yushu, and Zhouqu identifies livelihood security as the basic starting point for rehabilitation and reconstruction, calls for giving priority to rehabilitation and reconstruction of urban and rural housing, and also cites the need to rehabilitate public service facilities and infrastructure, increase employment and income levels, and protect the legal rights and interests of residents of disaster areas. Other important objectives of postdisaster reconstruction include promoting the economic development of disaster areas, developing characteristic dominant industries, and optimizing the industrial structure and spatial layout.

The Counterpart Support Plan for Post-Wenchuan Earthquake Rehabilitation and Reconstruction defined the contents, methods, and tasks of the counterpart support mechanism. It required donor provinces to offer services (such as preparation of plans and building and rehabilitating housing, public service facilities, and infrastructure) and to provide material support (machinery, equipment, instruments, building materials). It also encouraged enterprises to invest in factory establishment and market service facilities for trade and circulation, and to participate in the establishment of operational infrastructure.

**5. Take advantage of support from all sectors of society.**

China's postdisaster reconstruction highlighted the involvement of all social sectors in postdisaster reconstruction. The central government focused on the concurrent use of domestic and foreign resources and actively supported disaster areas in making use of foreign loans in postdisaster reconstruction – that is, it required that the emergency loans on favorable terms offered by global financial organizations and foreign governments be used together with the central rehabilitation and reconstruction fund. The funds for postdisaster reconstruction came not only from the central and provincial reconstruction funds, but also from the fiscal funds of governments at various levels, one-to-one aid funds, loans from foreign governments, funds from Hong Kong SAR and Macao SAR for reconstruction, bank loans, and other sources. The central government also indicated that the proposals of foreign experts should be incorporated in the planning for postdisaster.

China sought to involve more than governments in reconstruction; it also sought to make full use of civil forces, including NGOs, and to encourage self-help by affected people. The state formulated preferential policies and offered various conveniences to encourage enterprises, social groups, and individuals across the country to invest in the disaster areas and to help build factories and infrastructure by market-oriented means. It also encouraged financial institutions to provide loans on favorable terms to enterprises involved in counterpart assistance.

**6. Strengthen the monitoring and assessment of reconstruction projects and funds**

In order to ensure the smooth implementation of postdisaster reconstruction projects and fund security, the Chinese government closely monitored and continually assessed reconstruction projects and funds. The government regularly published information on the receipt and use of funds, on materials donated, and on the source, quantity, allocation, distribution, and use of funds and materials for rehabilitation and reconstruction; it also sought to give urban and rural communities a role in supervising and inspecting funds and materials.

In addition, the system establishing legal accountability for the project was strictly implemented, as were the systems for public bidding, contract management, and project supervision. The government strengthened the supervision over the quality and security of construction projects and over the safety and quality of products, organized the inspection of key construction projects, carried out project final-acceptance stipulations strictly, and only put into use those projects that had gone through final acceptance.

Related departments, including departments in charge of supervision and audit, also enhanced the tracking and audit measures throughout the raising, allocation, distribution, and use of funds and materials for rehabilitation and reconstruction, and they published the audit results regularly to ensure that funds were used for designated purposes only.

Finally, information about the postdisaster rehabilitation and reconstruction project was communicated immediately by relevant departments through the leading authorities in charge of rehabilitation and reconstruction, and then released to society, which exercised social supervision.

China's achievements in postdisaster reconstruction have been remarkable and can be seen to reflect the advantages of the socialist system, the tradition of "one in trouble, all to help," and the cohesion and solidarity of the Chinese people. At the same time, it is important to recognize that China's postdisaster reconstruction approach, especially where catastrophic disasters are concerned, is still being developed. The institutional establishment and organizational security system are therefore not perfect, and the problems met with in postdisaster reconstruction should be acknowledged and analyzed.

## Basic Principles for Future Post-disaster Reconstruction

**1. Properly balance prevention and reconstruction.**

Balancing the relationship between prevention and reconstruction has two components: first, ensuring that the disaster forecasting and prevention mechanism will reduce the losses caused by disasters; and second, taking prevention of future geological disasters into account in the course of postdisaster reconstruction. The latter involves comprehensively considering technical factors, ecological factors, and economic factors; following ecological laws, economic laws, and social laws; and basing project contents on clearly established facts and principles.

**2. Properly balance national investment and social investment.**

Because of the complexity, extent, and expense of postdisaster reconstruction, the work requires the support of all sectors of society, including the population affected by the disaster, whose participation in self-help activities is indispensable. At the same time, the government serves as decision maker for and organizer of postdisaster reconstruction.

**3. Properly balance overall focus and specific focus.**

Postdisaster reconstruction should focus both on the overall "big picture" and on the requirements of individual projects. Reconstruction planning should proceed based on a scientific outlook on development, should rationally arrange postdisaster reconstruction projects, and should give priority to the construction of urgent civil facilities and infrastructure, including homes, schools, hospitals, roads, and utilities.

**4. Properly balance short-term and long-term considerations.**

Postdisaster reconstruction can by no means be completed overnight. It is important to combine short-term and long-term planning, so that the short-term planning provides a foundation for long-term planning.

**5. Investment enhancement should include performance management.**

Enhancing the fund investment in postdisaster reconstruction should include strengthening the management of reconstruction funds performance. Management should include tracking of funds, materials, and projects and as well as establishing an accountability mechanism and a mechanism to assess fund performance.

## Policy Recommendations

**1. Perfect the legal system relating to postdisaster reconstruction.**

Postdisaster reconstruction work cannot be carried out smoothly without the effective support of a series of laws. In the long run, perfecting the emergency-related legal system will reduce losses and restore social stability as soon as possible after a disaster, thus ensuring that government-led postdisaster reconstruction can proceed effectively. It is clear that countries subject to frequent disasters all rely on laws and the legal system to facilitiate postdisaster reconstruction. For example, Japan has a series of 52 laws releated to disaster reconstruction and mitigation that can be divided into five categories: basic laws, laws regarding disaster prevention and disaster prevention planning, laws regarding disaster emergencies, postdisaster reconstruction and rehabilitation laws, and disaster management and organization laws. A legal system of this type constitutes a guarantee of postdisaster rehabilitation and reconstruction work.

China, too, is gradually producing such a system of laws. Soon after the Wenchuan Earthquake, the State Council issued the Regulations on Post-Wenchuan Earthquake Rehabilitation and Reconstruction, the first special regulations on postearthquake reconstruction in China. They played a significant role in the reconstruction: they were considered an important legal basis by the various regions and departments carrying out the postdisaster rehabilitation and reconstruction work. The Law on Precautions against Earthquake and Relief of Disasters was revised based on the experiences after the Wenchuan Earthquake; it took effect officially on May 1, 2009.

Although China has made progress in constructing a legal system concerned with postdisaster reconstruction, there are still many concrete issues to be resolved that will require enacting or amending relevant laws. One issue at the constitutional level, for example, concerns the relationship between central responsibility and local responsibility in respect of postdisaster reconstruction; other problems have to do with the consistency of, labor division for, and unified use of various public powers, as well as the basic rights and obligations of affected people and other citizens. At the administrative law level, the relief and reconstruction mechanisms involving administrative domination, market involvement, social supplementation, and individuals' effort need to be defined clearly. At the social law level, survivors' rights and other rights regarding social help, health, education, housing, and development need to be handled properly. China should learn from countries like Japan and the United States and promulgate laws and regulations to clarify rights and obligations for future postdisaster reconstruction.

### 2. Increase the investment in prevention.

As global practices make clear, it is less effective to invest in postevent reconstruction than in event control, and less effective to invest in event control than in pre-event prevention. Luo Yun, an economist and dean of the faculty of engineering at the China University of Geoscience, calculates the ratio of preventive investment in security to the postevent investment in rectification as 1 to 5; this basic quantitative law of safety economy says that Y 1 invested before an event = Y5 invested in postevent rectification.[1] This formula shows the importance of a mechanism that relies mainly on pre-event prevention and event control and that is only supplemented by postevent remedy. It also shows why it makes sense to increase the investment in and support for emergency management and an early warning system, and to improve the accuracy of the government's forecast of public emergencies.

The scope of public expenditure should be rationally adjusted to ensure funding of ongoing emergency management work. First, based on the perfection of the public emergency management system and the integration and restructuring of related functional departments, the funds required for the normal operation of the emergency management department should be incorporated into the financial budget system of the government; the emergency management funds should be increased gradually. Second the emergency funds spread across various departments should be integrated to avoid disorderly and fragmented fund distribution. In addition, the investment of budget funds should be regulated and emergency management functions integrated. Finally, a public emergency risk prevention fund should be considered. Such a fund would have diversified sources, and should be the recipient of contributions from all social sectors. The central government would provide supplementary funding to some poor local governments for emergency management and remedial work through the transfer payment of this fund.

### 3. Fully mobilize forces of the government and all social sectors for relief and reconstruction.

The primary tasks of postdisaster reconstruction include the settlement of affected people, production recovery, prevention and control of secondary disasters, reconstruction of infrastructure, soil antipollution treatment, physical and psychological care of affected people, reconstruction of the social security system, and improvement of the early warning and crisis management mechanism for earthquake and other natural disasters. All these tangible and intangible public services should be actively offered by the government, since the market may be unwilling or unable to provide them or may do so less efficiently. In the early stage of reconstruction, the government should effectively make up for the market failure; it should outsource the production of some quasi-public products in some competitive and profitable fields and have the market fulfill them. The government should set up an efficient and orderly market trading environment and sound market development environment, realize the efficient allocation of production factors, and play the role of economic regulator and market supervisor.

For example, the government could offer preferential policies, such as financial subsidies and tax reduction or exemption, to enterprises involved in the reconstruction of disaster areas, or it could encourage and absorb the active participation of domestic

1 Luo Yun, "Safety is the Productive Force," CCTV. com, http://www. cctv. com/news/china/20040325/101254. shtml.

and overseas market forces to maximize the benefits brought by reconstruction. For fields where both the market and the government are powerless or fail, the involvement of civil society organizations should be enlisted. With the rapid deployment of postdisaster reconstruction, when the environment makes operation of infrastructure under basic market factors a possibility, the task for the reconstruction should be transferred from the government to the market. Social forces like civil society organizations have always participated in the operation of both the market and the government, and their flexible social integration function should be taken advantage of. To promote the cohesion, integration, and cooperation of all parties, the government should draft standards for, organize, coordinate, and guide all parties to realize specific goals as well as the common vision of good social governance through multicenter governance.

To fully mobilize all forces for disaster relief and reconstruction, the government must play a dominant role; the initiative and enthusiasm of the disaster areas and its residents must be tapped; NGOs must be encouraged to play an active role; and the counterpart support mechanism should be improved.

**4. Consider livelihood and industrial development comprehensively.**

Postdisaster reconstruction should put people and their needs first. In the long run, however, livelihood development and industrial development are not contradictory but unified. Industrial reconstruction is the fundamental way to promote economic development, increase employment, and maintain stability in disaster areas.

Considering livelihood and industrial development comprehensively means putting employment in an especially important place in postdisaster rehabilitation and reconstruction. Industrial reconstruction should insist on the employment-first principle – that is, it should make expanding employment a priority; it should actively support the development of individual and private enterprises, small and medium-size enterprises, and labor-intensive industries; and it should perfect the policies promoting employment in order to realize the benign interaction between reconstruction and the expansion of employment. Using diversified measures such as counterpart support, labor export, directed recruitment, work for food, independent business start-up, and creation of public service positions, reconstruction should rehabilitate and reconstruct employment service facilities, strengthen employment assistance, and ensure stable employment for the labor force in disaster areas. Moreover, postdisaster reconstruction should be based on characteristic resources and superior resources, be oriented by the market, focus on product structural adjustment and the cultivation of mainstay enterprises, develop industry through agriculture and resource transformation, insist that the factors of production be devoted to superior enterprises and industries, and support leading agricultural products processing (those with a clear brand, a market, huge potential, and good performance) and some mineral-intensive processing enterprises.

**5. Strengthen supervision and improve performance.**

In response to some irregular phenomena in the use of postdisaster reconstruction funds, the supervision and management of postdisaster reconstruction funds should be strengthened. Specifically, budget management should be better regulated to improve the performance of postdisaster reconstruction funds. Each link in the funding chain should be improved.

First, the postdisaster reconstruction budget should meet needs without any waste. The budget should be based in part on a benefits-costs analysis and should consider both the short-term and the long-term benefits of projects relative to the budget expenditure. Budget expenditures should be verified as reasonable and appropriate.

Second, the postdisaster reconstruction fund disbursement procedures should be regulated, and disbursement should conform to the centralized treasury receipt and payment system while the demand for funds is not very urgent; meanwhile, the monitoring of budget implementation should be strengthened, and a dynamic monitoring system to ensure the regular use of financial funds should be put in place.

Third, the monitoring and management of postdisaster reconstruction project funds should be strengthened and the transparency of funds improved. The postdisaster reconstruction fund monitoring mechanism should be established, and supervision over budget making and implementation enhanced. Supervision of postdisaster reconstruction funds should take places at all stages – before, during, and after a disaster – to ensure the standardization, safety, and effectiveness of financial funds. The government should conduct itself openly; except where classified information is involved, the distribution and use of postdisaster reconstruction funds should be made public, and the supervision of all social sectors and citizens accepted.

Finally, a system to assess postdisaster reconstruction project performance should be set up in order to improve the performance of postdisaster reconstruction funds. Government departments at various levels, especially finance departments, should focus both on the impact and effect of using the public resources and on the investment of funds. Finance departments might consider having ordinary people investigate and assess the postdisaster reconstruction work, publish the results, and accept the supervision of all social sectors.

# Appendix 1:

## Japan's Hanshin-Awaji Postdisaster Reconstruction Policies and Organizational System

On January 17, 1995, a 7.2 magnitude earthquake occurred in the Hanshin region of Japan, with Kobe as the center. More than 6,500 people were killed, more than 30,000 were injured, and nearly a third of a million people were left homeless. The direct economic losses amounted to to ￥10 trillion (equivalent to approximately US$100 billion), and the reconstruction after the earthquake took nearly 10 years.

### Reconstruction Laws and Policies

Japan has 24 laws related to earthquakes in Japan, including the Disaster Counter-measures Basic Law, Earthquake Insurance Law, Building Basic Law, and Disaster Relief Act. After the Great Hanshin Earthquake, Japan passed 16 special emergency laws, including the Special Financial Assistance to Deal with the Hanshin-Awaji Great Earthquake Disaster, and the Special Measures Law on Hanshin-Awaji Earthquake Revival; these mainly involved tax breaks for residents and businesses, special financial assistance, transfer payments, and similar issues.

The government also issued a number of fiscal policies to provide financial assistance through the additional financial budget, financial transfer payments, and other measures. The central finance department made two additional budgets and invested ￥5.02 trillion in the disaster area of Hyogo Prefecture. The central government, prefecture, and municipality bore 50 percent, 25 percent, and 25 percent of the funding for reconstruction, respectively.

Under Japan's financial policies, private financial institutions and government-affiliated financial institutionscut loan rates and increased loan amounts. Long-term low-interest loan financing is available for equipment funds and operating funds of affected SME reconstruction, and corporate loans can account for 90 percent of the funding needs for a period of up to 20 years. The upper limit of loans for affected family property is ￥3.5 million, and the interest-expense ratio is 2 to 3 and 1 to 3 for the central and local governments, respectively.

After the Great Hanshin Earthquake, the severely affected area of Hyogo Prefecture and Kobe City quickly issued bonds to financial institutions to raise ￥880 billion for the establishment of the Rehabilitation Fund; the interest generated by the issuance of bonds was to be subsidized by the central government in the form of a local tax payment. The Japanese Ministry of Finance issued disaster bonds in the amount of ￥10 trillion (about US$100 billion) in order to compensate for the additional fiscal expend-itures.

The Japanese government has issued a series of tax relief measures. For example, Kobe

City has sharply cut municipal taxes, and most of the financial income is from municipal bonds. The government also has reduced fixed assets tax and income tax for residents of disaster areas to reduce their burden.

On April 1, 1995, Kobe City and Hyogo jointly invested ¥20 billion yen in foundation funds and issued bonds to financial institutions to raise ¥880 billion; the resulting ¥900 billion was used to establish the Hanshin-Awaji Rehabilitation Fund, which was mainly used for the repair and reconstruction of residential, industrial, employment, education, and other projects.

The operating framework of the Rehabilitation Fund is shown in figure A1.1.

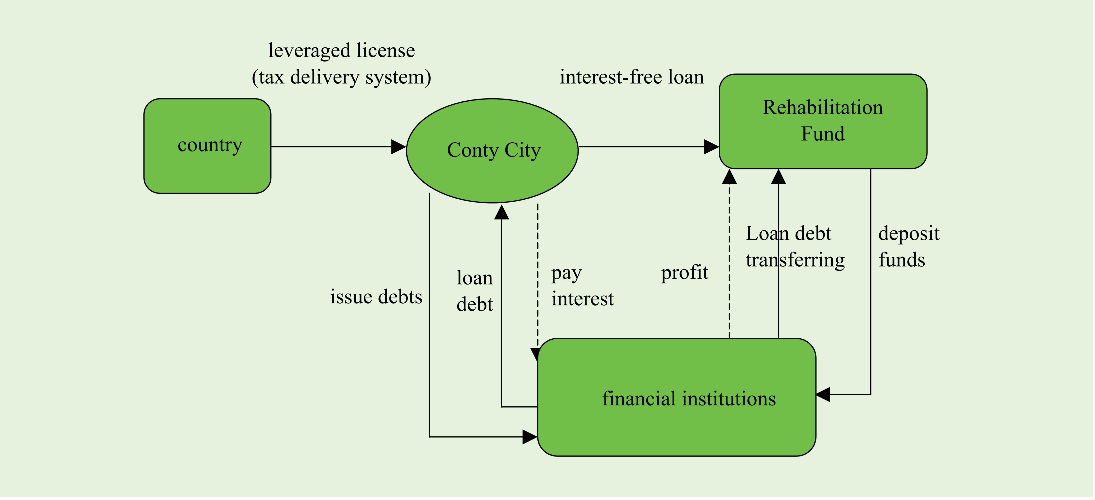


**Figure A1.1 Operating Framework for Hanshin-Awaji Rehabilitation Fund**

Source: Authors' representation.

## Earthquake Relief System

The Japanese earthquake relief system has seven components.

(1) Disaster relief organizations and management agencies. The Prime Minister's Office set up the Central Disaster Prevention Conference, which in turn set up the Disaster Countermeasures Headquarters. When a disaster occurs, the prime minister serves as a commander for the integrated scheduling of all possible relief forces to carry out cooperative disaster relief.

(2) Emergency management system. The Disaster Countermeasures Headquarters handles coordinated scheduling at the central government level; the disaster area is under the local command of the Disaster Site Countermeasures Headquarters; and the jurisdiction regions are under the Disaster Countermeasures Headquarters. After the Great Hanshin Earthquake, the integrated relief system – consisting of emergency fire relief assistance teams, other emergency assistance teams, and Self-Defense Forces (SDF) disaster relief teams – was established. One of the five major tasks for the Self-Defense Forces is disaster relief.

(3) Relief management system. The relief management mechanism consists of the basic system of disaster relief as specified in law (Relief Basic Law, Countermeasures Basic Law, and others), relief contents, and relief systems, including self-rescue, public rescue, and mutual rescue.

(4) Civil disaster relief. The civil earthquake

relief system was designed to quickly deliver required relief supplies to disaster areas to solve the food and clothing problems of quake-stricken areas.

(5) Risk assessment. Japan has established a relatively complete evaluation index system for earthquake disaster reduction capacity. It takes into account such factors as earthquake prediction and monitoring, inputs of earthquake reduction and relief, planning and implementation of earthquake reduction and relief, and funds for postdisaster reconstruction.

(6) The popularization of disaster prevention knowledge. Japan's government has strengthened earthquake science public education. During the "Disaster Prevention and Volunteer Day" (or week) localities receive educate about disasters and participate in earthquake drills with the fire brigade. Japan begins disaster prevention education in elementary school. After the Great Hanshin Earthquake, the government began periodically publishing the latest earthquake predictions made by the authoritative Central Disaster Prevention Conference.

(7) Seismic standards for buildings. After the Great Hanshin Earthquake, Japan amended the Building Standards Law three times. The current standard requires that buildings' seismic capacity should be more than VIII (8) with a use period of more than 100 years.

## Specific Measures Taken in Postdisaster Reconstruction

The Japanese implemented reconstruction in phases after the Great Hanshin Earthquake. Postdisaster reconstruction was in four phases: preparation phase, through the end of 1995; completion of reconstruction and comprehensive assistance for the disaster area, through early 1998; self-support in the disaster area, from early 1998 to 2000; and full recovery, from 2000 to 2005.

A variety of reconstruction plans guided the postdisaster reconstruction, including the Three-year Plan of Residential Emergency Rehabilitation, the Basic Framework of the Great Hanshin-Awaji Rehabilitation Plan, the Emergency Infrastructure Three-year Plan, the Kobe Rehabilitation Plan, and the Hanshin-Awaji Rehabilitation Plan. The five reconstruction plans had profound effects on the whole reconstruction effort and sparked a "creative revival" in disaster prevention and reconstruction of industry, infrastructure, and other areas. "Community reconstruction," in which residents of affected areas helped to restore their homes, was another aspect of the postdisaster work. Community reconstruction funds mainly came from government funding. The community reconstruction organizations worked throughout the disaster areas to solve the difficulties and problems of the affected population, to help them build their own homes, and to promote the smooth progress of the reconstruction work.

The reconstruction process also involved offering living and employment assistance. Living assistance was offered through a funding system for life reconstruction support that was established after the earthquake. Various distribution standards were developed, and depending on circumstances support was provided to low-income people, families living in difficulty, the disabled, and those whose homes were completely or partly destroyed. Employment assistance was offered through subsidies to enterprises to encourage public employment, vocational training, and other measures.

Housing reconstruction was an important aspect of the overall reconstruction process. Hyogo Prefecture provided temporary housing for 48,000 families, and Kobe City provided temporary housing for 9,939 families; by the end of 1997, Kobe City and Hyogo Prefecture had provided permanent housing for a total of 82,000 families, and public housing for a total of 10,000 low-income families. Residential reconstruction was financed as follows: The proportion of capital to come from government and from individuals was determined according to the different degrees of damage and the property status. The financial institutions provided low-interest loans to disaster area residents reconstructing their homes, extended the loan time, and reduced real estate taxes to support housing reconstruction.

Industrial recovery and reconstruction were addressed in the Kobe Rehabilitation Plan, and specified the following: The financial institutions were to give low-interest loans to those who created companies and operated innovative SMEs as well as to local industry, and the government was to provide investment support for entrepreneurs, infrastructure repair, and reconstruction. The SMEs were to be considered the assistance targets, and the financial institutions were to offer them long-term, low-interest financing for equipment funds and operating funds. Urban industry was to be revived by strengthening the leading industries and by supporting the industries making slow progress in recovery. Priority was to be given to reconstruction projects for disaster area enterprises in awarding contracts and other measures. Upgrading of industrial structure was to be promoted by by accelerating industrial incubator effects and modifying the traditional industries with high-tech.

Finally, reconstruction recognized the terrible trauma experienced by those who lived through the earthquake, particularly the elderly and children. Japan regarded the rescue of people's psyches as a long-term mission and made sure to expand rather than contract mental health services as time went on.

# Appendix 2:

## Disaster Prevention and Relief System for South Asian Earthquake in Pakistan

On October 8, 2005, a 7.6 magnitude earthquake occurred in the northern part of Pakistan. It killed 73, 338 people, and left more than 600, 000 houses collapsed or damaged and 3.5 million people homeless. The reconstruction cost was more than US $ 5 billion.

### Earthquake Reduction and Relief Initiatives

The Pakistan Reconstruction Bureau formulated two documents in March 2006 to guide postdisaster reconstruction: Rural Postdisaster Restoration and Reconstruction Policies, and Urban Postdisaster Restoration and Reconstruction Policies.

After the South Asian Earthquake, the Pakistani government quickly set up two command centers to oversee the resuce, the Ministry of Earthquake Relief and Reconstruction, and the National Crisis Management Team. After the rescue, Pakistan set up a Reconstruction Authority to plan and coordinate reconstruction work. Because the US $ 5 billion required for reconstruction was more than Pakistan could afford, the government took full advantage of available international aid. Pakistani President Pervez Musharraf used the media to reach out to the international community for help. Forty days after the earthquake, more than 70 countries and international organizations had commited to providing funding in the amount of US $ 5.8 billion – more than Pakistan's expected funding requirements of US $ 5.2 billion.

### Specific Initiatives for Postdisaster Reconstruction

The government of Pakistan made a commitment to the international community that it would use the contributions in an open, transparent, and rational way, that it would regularly disclose the use of the reconstruction funds and reconstruction progress, and that it would accept supervision and inspection from the international community and United Nations.

The government also decided to employ a self-reconstruction strategy after the earthquake. Pakistan called on residents of affected areas to rebuild their homes with their own hands; the government would provide funding and technical support for the reconstruction, and pay wages to those who rebuilt their own homes to ensure them a livelihood. The government also provided different amounts of financial aid depending on degree of loss.

Skills training was part of the reconstruction process in Pakistan. In order to meet the needs of various types of skilled personnel in the reconstruction, the Pakistani government trained people in affected area in reconstruction skills at one of 12 postdisaster reconstruction training centers.

The Pakistani government banned housing reconstruction near rivers or landslide-prone areas to avoid recurrence of disasters. It also emphasized postdisaster environmental protection work. The Pakistani government invited the United Nations to jointly organize the environmental protection work in disaster areas. The UN assessed potential landslides, waste management, natural resource issues, and other environmental problems in the disaster areas, and made recommendations about how to address them.

# Appendix 3:

## Qiyi Yingxiu Middle School

Qiyi Yingxiu Middle School was built with Y 46.54 million in special party membership dues. Seen from the air, the building appears to be shaped like the Chinese character "seven" – standing for the seventh month, July, the first day of which is the anniversary of the establishment of the Communist Party of China. The red building is meant to represent a donation box to recall the special party membership dues paid to build the school. (See figures A3.1 – A3.2.)


**Figure A3.1 Two Views of Qiyi Yingxiu Middle School.**
Source: Authors.

**Figure A3.2 Qiyi Yingxiu Middle School**
Source: Authors.

Qiyi Yingxiu Middle School was formerly known as Xuankou Middle School. It was a key middle school in Aba, built in 2006 with more than Y 60 million. When the Wenchuan Earthquake occurred in May 2008, there were 1,500 students and 130 others in the school; 38 students, 8 teachers, and 4 family members were killed by the earthquake, and the school buildings were severely damaged. The buildings now form Wenchuan Earthquake Relics Park (figures A3.3 – A3.4). After the earthquake, students were transferred first to Changzhi, Shanxi, and then to Shuimo Town, which was 40 miles from Yingxiu Town; they remained there until Qiyi Yingxiu Middle School was completed in late 2010.


**Figure A3.3 Views of Wenchuan Earthquake Relics Park (the original Xuankou Middle School)**

Source: Authors.

**Figure A3.4 Further Views of Wenchuan Earthquake Relics Park**

Source: Authors.

The new campus is divided into four parts: a commemoration area, a sports area, a teaching area, and a living area. There is also a classroom building to accommodate 24 classes or 1,200 students, a canteen-gymnasium, a breezeway, two student dormitory buildings, a circular 300 m (imported synthetic surface) track, soccer field, basketball court, volleyball court, badminton court, and other sports facilities. The new school building is also equipped with solar water heaters.

The foundation was laid for the new Qiyi Yingxiu Middle School in January 2010. The school was jointly designed by the Tsinghua University School of Architecture and the Architectural Design Institute, and it was constructed by the Jiangxi Haili Construction Group. Wu Liangyong, a member of the Chinese Academy of Sciences and the Chinese Academy of Engineering, was invited to serve as a design consultant. The school covers an area of 42,000 $m^2$, and the building complies with the high antiseismic and seismic protection standards (VIII [8] degrees for the former, IX [9] degrees for the latter). On October 29, 2010, at a ceremony attended by 200 national party members, Wenchuan Qiyi Yingxiu Middle School was completed and formally inaugurated.

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